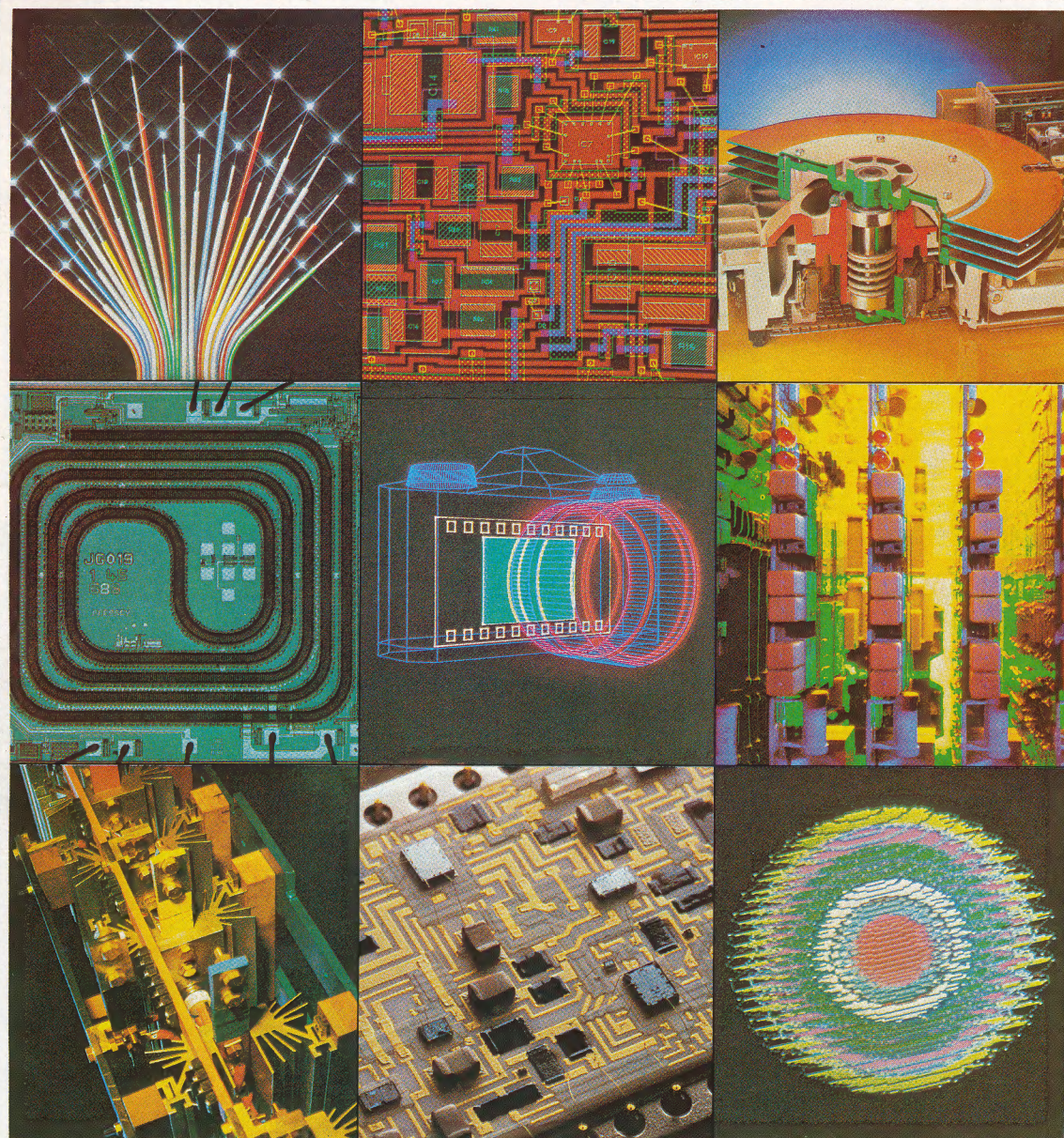


ITEC

Information
Technology
Electronics
Computers

INDEX



SI
in weekly
parts

THE HOME STUDY COURSE IN ELECTRONICS AND COMPUTERS

U.K. 99p Australia \$2.50 New Zealand \$3.00 South Africa R2.75

INDEX

POSTAL SUBSCRIPTIONS

UK readers

You can arrange to receive weekly copies of *I.T.E.C.* at 99p each inclusive of postage and packing. Simply calculate the cost of your subscriptions by multiplying the number of parts you require by 99p and send a cheque or postal order for that amount to:-

Subscriptions Dept., GEJ Publishing Ltd
187 Oxford Street, LONDON W1R 1AJ.

with a note of your name and address, where you wish the copies to be sent and the part number from which you want the subscription to start. Please allow 28 days for your subscription to be processed plus postal time.

Eire readers

As above, but you should calculate the cost of your subscription at IR£1.75 per part.

Other overseas readers

May pay in the currency of their choice provided that its value when converted to Sterling is £1.50 per part. Minimum subscription 10 parts.

CONSULTANTS

This series has been produced in collaboration with **TEXAS INSTRUMENTS** Learning Centre. Editorial and graphics assistance is gratefully acknowledged.

U.K. Technical Consultant

Dr. Robert King, Reader in Communications Engineering, Imperial College of Science and Technology, London.

BINDERS

U.K. and Eire

Details of how to obtain your binders for *I.T.E.C.* appear on the back cover.

Australia

Write to *I.T.E.C.* Binders, Gordon and Gotch Ltd., PO Box 213, Alexandria, New South Wales 2015.

New Zealand

Write to *I.T.E.C.* Binders, Gordon and Gotch (NZ) Ltd., PO Box 1595, Wellington

South Africa

Binders are available at R7.95 (please add sales tax) from any branch of Central News Agency. In case of difficulty, please write to Intermap, PO Box 57934, Springfield 2137.

Other countries

Binders are available from your local newsagent.

BACK NUMBERS

U.K.

Back numbers can be ordered from your newsagent or from *I.T.E.C.* BACK NOS., Whinfrey Strachan Ltd., 187 Oxford Street, London W1R 1AJ. Price 99p each inc p+p. Please allow 21 days for delivery.

Eire

As for U.K. but please remit in Sterling if ordered by post.

Other countries

Copies available from your local newsagent.

Published by GEJ Publishing Ltd.

Distributed by Whinfrey Strachan Ltd. 187 Oxford Street, London W1R 1AJ

© Gruppo Editoriale Jackson Ltd. 1984

© This edition G.E.J. Publishing Ltd. 1985

Printed in England by Southernprint Ltd.

Erratum: Part 44

Due to a printer's error, the Glossary on page 1402 is partially incomplete. The full Glossary is reprinted below.

Glossary

bit-interleaved TDM	time division multiplexing method in which a number of digital signals are combined bit by bit
character-interleaved (byte-interleaved) TDM	time division multiplexing method which combines digital signals together byte by byte. Synchronisation of character-interleaved TDM signals is superior to that of bit-interleaved TDM signals
data concentrator	device which combines data signals together using internal buffers to store signals until free time slots are available. For example a statistical multiplexer.
dynamic multiplexer	multiplexer which combines speech and data signals together by transmitting the data signals when speech channels are unused and during pauses in conversation
speech plus data multiplexer (s+dx)	multiplexer which combines speech and data signals in a fixed manner
statistical or intelligent multiplexer	multiplexer which combines data signals in a statistical relationship depending on the amount of data in each signal

Note: *italicised entries refer to photographs or diagrams.*

A

AC (Alternating Current), *see* current

acceptor atom, 58, 156-9

access, 72, 364, 373-4

direct, 75, 199, 202, 569, 606-16

random, 75

sequential, 75, 198

serial, 569-72

time, 74, 198, 366, 648-9

uniform, 190

accumulator, 134

accumulator register, *see* registers

accuracy, *see* reliability

acoustic coupler, 1373-5

active interfaces, *see* busses: BIU

ADC (Analogue-to-Digital

Converter), 390-3, 461-2, 673,

681-2, 705-14, 721, 783-4, 816

aliasing, 712-13, 721

applications, 712-31

counter-ramp, 705-7, 711

data conversion systems, 724-31

follower, 707

integration, 709, 711

low-pass filter, 713

parallel (flash), 710-11

quantization error, 706-7, 726-7,

731, 817

see also DAC

add routine, *see* routine

adder, 67-9, 341-9, 921-9, 954-6

adder-subtractor, 37, 335, 571-2

addition, 67-9, 921-9

address bus, *see* busses

address field, 1484, 1485

address register, *see* registers

address space, 71

admittance, 718-20, 919

aerial

dipole, 798

transmitting, 796

AGC (Automatic Gain Control),

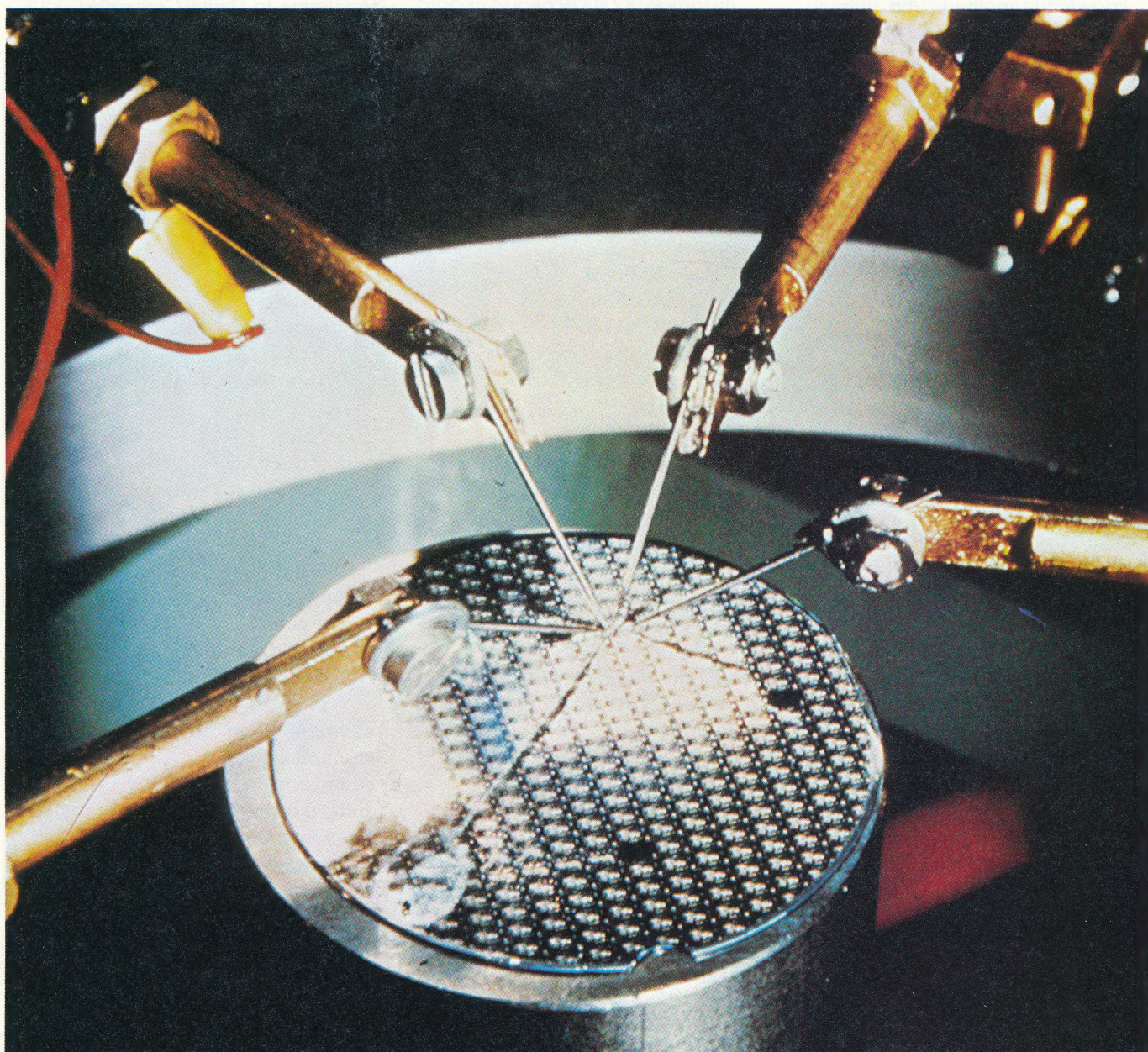
see amplifiers: gain control

AI (artificial intelligence), 663,

968-85, 993-1007

control metaphors, 981-3,

1007



- action-centred, 981
- GPS, 981-3, 984
 - difference-procedure table, 982
- object-centred, 981
- request-centred, 981
- single-thread, 981
- described, 968
- domain, 996
- domain expert, 995
- games, 979-80
- goal tree, 969, 970, 995
 - AND node, 969, 995
 - AND/OR node, 995
 - OR node, 969, 995
 - reduction, 969, 1006, 1007
- goals, 969
- hill-climbing, 977-8
- IKBS, 1004
- knowledge engineer, 968, 995
- MINIMAX, 979, 980, 984
- paradigms, 984-5, 993-1007
 - backward chaining, 984, 995
 - forward chaining, 984, 995
 - generate-and-test, 984
 - rule-based, 984-5, 993-1007
 - antecedent-consequent, 985, 993
 - expert, 984, 993
 - inference net, 985, 994, 995
 - knowledge-base, 995-7
 - logic, 999-1000
 - MYCIN, 997-8
 - rule-base, 985
 - XCON, 984, 999
- picture analysis, 970-3, 980
- reading, 1006
- searches, 974-9
- specialists, 969
- static evaluator, 979
- translating, 1006
- ALGOL (ALGOrithmic Language), 442
- aliasing, *see* ADC
- alphanumeric codes, 42, 131
 - see also* ASCII; Baudot; EBCDIC; Selectric code
- Alternating Current (AC), *see* current
- alternator, 533-5
- ALU (Arithmetic and Logic Unit), 67-8, 70, 345, 921-5, 1159, 1160, 1198-1203, 1346, 1405
- Alvey Programme, 1003
- AM (Amplitude Modulation), 21-2, 79, 110, 231-2, 381-2, 386, 908-9, 1341
 - described, 381
 - envelope, 908
 - spectrum, 910
- American Standard Code for Information Interchange, *see* ASCII
- ammeter, 378
 - symbol, 1577
- ampere, 82-3
- amplifiers, 47-57, 381-2, 820-32, 1298
 - bandwidth, 389
 - broadband, 389
 - buffer, 682
 - cascaded, 820
 - cut-off frequency, 389
 - decay, 385
 - differential, 53, 389
 - distortion, 821-3, 828
 - efficiency, 825-6
 - frequency doubling, 829
 - gain control, 53-4
 - HPA, 1189-90, 1232
 - klystron, 1232-7
 - LNA, 1189-90, 1232, 1239
 - negative feedback, 389
 - parametric, 1237
 - power, 821-32
 - class A, 824
 - class AB, 824, 827, 828
 - class B, 826-8
 - class C, 824, 829
 - classification, 824
 - IC, 831-2
 - preamplifier, 1063
 - push-pull, 826, 827
 - transfer characteristic, 824
- symbol, 1577
- transistor, 395-401
- TWT (Travelling Wave Tube), 1232-7
- voltage gain, 389
 - see also* op-amp
- Amplitude Modulation, *see* AM
- analogue circuits, 820-32, 849-60
- analogue computer, 3
- analogue filters, 1332-5
 - active, 1369-71
 - anti-aliasing, 713
 - band pass, 1144, 1147, 1332-5, 1369
 - band stop/reject, 1332-5
 - Butterworth, 1369-71
 - Chebyshev, 1370
 - high-pass, 745-6, 1332-5, 1369
 - low-pass, 713, 1332-5
 - Sallen-Key, 1369-71
- analogue meters, 1008-16
 - AC, 1013
 - DC, 1010-13
 - disadvantages, 1057-9
 - FSD (Full Scale Deflection), 1010-11, 1014, 1057-9
 - multimeter, 1013-14, 1015, 1057
 - interface, 1016
 - resolution, 1057
 - sensitivity, 1010
- analogue multiplexer, *see* multiplexers
- analogue systems, 378
 - compared with digital, 378-94
 - data storage, 384-5, 388
 - described, 378-9
- Analogue-to-Digital Converter (ADC), *see* ADC
- analysis, *see* spectrum analysers and systems analysis
- AND gate, *see* gates
- apparent power, 846-8
- Appleton layer, 802
- applications software, 520
- Arithmetic Logic Unit, *see* ALU
- array processors, 1405
- artificial intelligence, *see* AI
- ASCII (American Standard Code for Information Interchange), 40, 42, 131, 1325, 1399, 1443, 1444, 1464, 1482, 1506, 1557
- pseudo-, 1507
- assembler, 13, 447, 497, 630, 1278
 - described, 630
 - directive/pseudo-instruction, 634
 - macro-instruction, 635
 - memory location counter, 633
 - one-pass, 633
 - symbol table, 633
 - two-pass, 633
- asymptotic plots, *see* Bode plots
- ATE (Automatic Test Equipment), 1116
- atomic number, 58
- atomic weight, 58
- attenuators, 1071, 1302-4
- audio transformers, *see* transformers
- Automatic Gain Control (AGC), *see* amplifiers: gain control
- Automatic Test Equipment (ATE), 1116
- autotransformers, *see* transformers

B

back-up, *see* data processing

Backus Naur Form (BNF), *see* language

bandwidth, 389, 755

Carson's rule, 1150

facsimile systems, 1130-2

radio and television, 1026

satellite, 1186-9, 1235

signal, 1332

transmission medium, 1332

banking and commerce, 1166-74, 1504

CHAPS, 1172

EFT, 1166-7

electronic payment services, 1166-7

PIN, 1167

plastic card, 1167-9

POS terminals, 1169-71

networked, 1170-1

security, 1168, 1171

SWIFT, 1171-2

bar code, 838, 1169-70, 1262

EAN, 1169-70

laser, 1262

reader/wand, 1268

Barkhausen conditions, *see* oscillators

BASIC (Beginners All purpose

Symbolic Instruction Code), 14,

1436, 1438, 1455

BBC, 1569, 1593, 1595

control statements, 501-2

Electron, 1592-3, 1595

loops, 500

programs, 500-1

Sinclair SuperBASIC, 1595

statements, 498-502

structured programs, 502

subroutines, 501-2

variables, 499

batch processing, *see* data processing

bathtub curve, *see* reliability

battery, 151

symbols, 1577

Baudot, 41

BCD (Binary Coded Decimal), *see*

binary number system

binary circuit, 65

Binary Coded Decimal (BCD), *see*

binary number system

binary number system, 19-20,

40-2, 62, 1290-8

addition, 67-9, 341-3, 344, 345

BCD, 20, 40, 41-2, 130, 241, 242,

284-92, 928-9, 930

conversion to decimal, 40-1, 122

division, 69, 343

fractions, 125-6

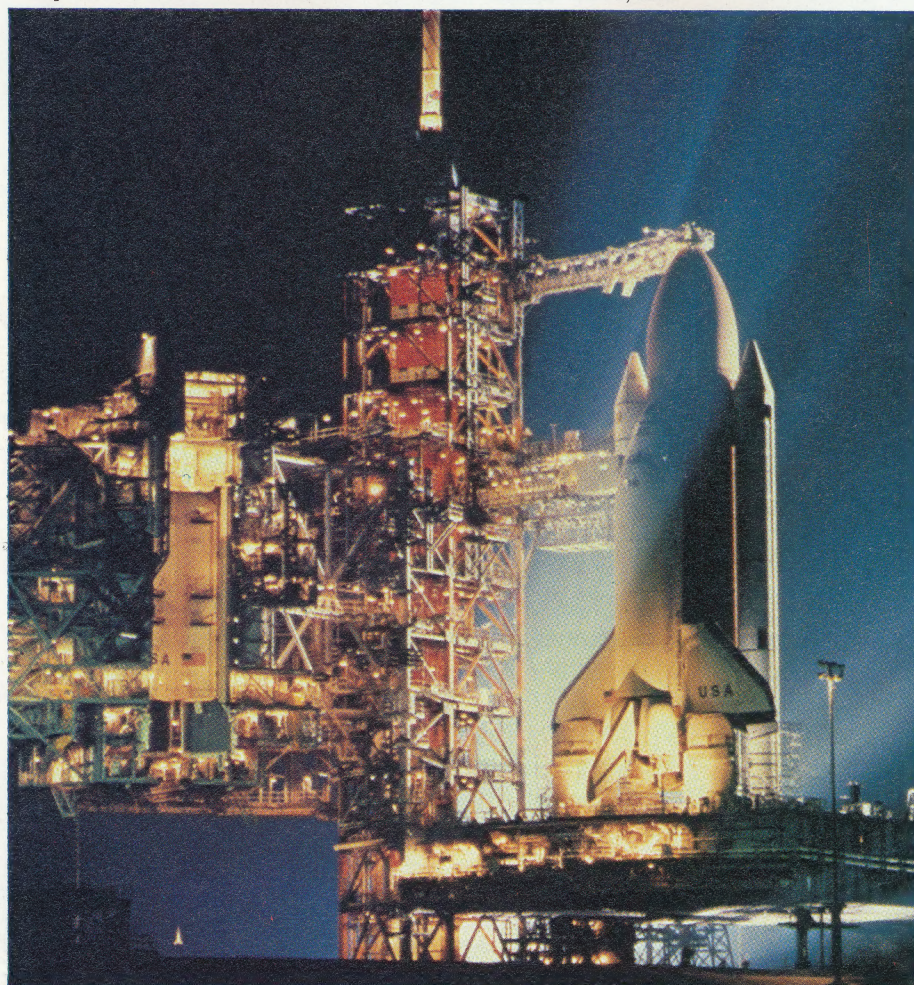


logical product, 244, 247
 logical sum, 244
 LSD (Least Significant Digit), 123
 maxterm and minterm, 248
 MSD (Most Significant Digit), 123
 multiplication, 69, 343
 one's complement representation, 342-4, 954-6
 positive and negative numbers, 127-8, 344-5, 956
 subtraction, 69, 344, 345
 two's complement representation, 128, 342-4
 variables, 243
 see also Boolean algebra;
 language
 bipolar transistor, *see* transistors
 bit (Binary digiT), 3, 4
 bit mapping, *see* graphics
 bit parallel, digit serial, 928, 954
 bit stuffing, 1484-5
 dibit, 1339
 length, *see* microprocessor
 LSB (Least Significant Bit), 675,
 MSB (Most Significant Bit), 675
 parallel bit transfer, 7
 BIU (Bus Interface Unit), *see* busses
 BNF (Backus Naur Form), *see*
 language
 Bode plots, 946-9, 1093, 1144
 Boolean algebra, 20, 62-4, 243-7,
 275, 283, 349
 see also De Morgan's laws
 break point, break frequency, *see*
 corner frequency
 bubble memory, *see* memory
 bucket, 644-6
 buffer memory, *see* memory
 bug, 448
 Bus Interface Unit (BIU), *see* busses
 busses, 61-2, 538-48, 1193, 1251-5
 address, 61-2, 66, 1160, 1251,
 1253-5, 1273-5, 1345-6, 1548
 BIU, 1540
 control, 61-2, 1160, 1273-80
 data, 61-2, 66-7, 1251-3, 1345-6,
 1548
 bidirectional, 1157, 1160
 open collector, 544-5
 three-state, 538-48
 Butterworth filter, *see* analogue filters
 byte, 4
 clock run-in, 1556
 CRAG (Control and Row Address
 Group), 1557

C

cable television, *see*
 telecommunications: television
 cache memory, *see* memory
 CAD (Computer Aided Design), 867,
 998, 1004, 1215-19, 1220,
 1222, 1403, 1404, 1407-8, 1412
 CAL (Computer Aided Learning), *see*
 education
 calibration, 758
 CAM (Computer Aided
 Manufacturing), *see* graphics and
 industry
 Cambridge ring, *see* LAN
 candela, 1261
 canonical forms, 248
 CAP (Computer Aided Print and
 Production), 1327
 capacitor, 109-10, 205-7, 234-6

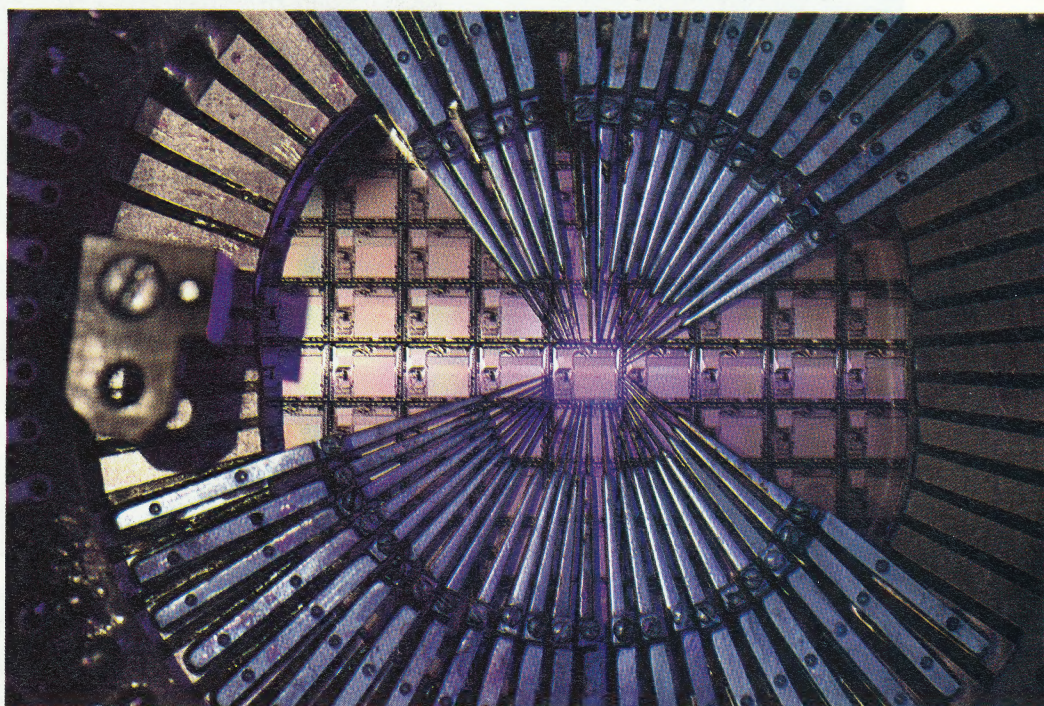
AC, 684-6, 715-20
 analogue memory, 383
 calculations, 559-60
 capacitive filter, 227-8
 charge, 556-60
 charging, 556-8
 coupling, 745
 discharging, 558
 drainage, 385
 energy storage, 271
 integrated, 413-14
 parallel, 234-5
 parasitic, 556-8
 power, 748
 properties, 686
 reactance, 686
 series, 234-5, 715-16
 symbol, 1576
 time constant, 207, 232
 types, 207, 235-6
 Carrier Sense Multiple Access with
 Collision Detection (CSMA/CD),
 see LAN
 carrier wave, 232



carry flag, *see* flag
 Carson's rule, 1150
 Cassegrain reflectors, *see* satellite communications
 cathode ray tube, *see* CRT
 CATV (Community Aerial Television), *see* telecommunications: television
 CCD (Charge-Coupled Device), *see* memory
 CCIR (International Radio Consultative Committee), 1136
 CCITT (International Telegraph and Telephone Consultative Committee), 1135
 definitions, 1340, 1375
 protocols, 1441-8, 1483-90
 recommendations, 1377-84, 1559
 Ceefax, *see* telecommunications: television
 cellular radio, *see* telecommunications: radio
 Central Processing Unit, *see* CPU
 CHAPS (Clearing House Automated Payment System), *see* banking and commerce
 Charge-Coupled Device (CCD), *see* memory
 chassis earth, *see* earth
 Chebyshev filter, *see* analogue filters
 chip, 11, 23, 26, 1151-61, 1258, 1279
 see also IC and wafer
 CIRC (Cross-Interleaved Reed-Solomon Code), *see* compact disc
 circuit analysis, 184-6
 circuit breakers
 symbol, 1577
 circuit protectors
 symbol, 1577
 circuit symbols, 1576-7
 clamping, *see* diodes
 Clearing House Automated Payment System (CHAPS), *see* banking and commerce
 clock, 33
 see also flip-flops and latches
 clock pulse, 105
 closed user groups, *see* office technology
 CMOS (Complementary Metal Oxide Semiconductor), *see* gates
 CNC (Computer Numerically Controlled), *see* industry

COBOL (COMmon Business Orientated Language), 13, 442, 507-8
 coding, *see* programs and programming
 Colpitts oscillator, *see* oscillators
 combinational circuit
 described, 240
 commerce, *see* banking and commerce; office technology; publishing
 Community Aerial Television (CATV), *see* telecommunications: television
 compact disc, 392, 763, 1268-72, 1269
 channel bits, 1272
 CIRC (Cross-Interleaved Reed-Solomon Code), 1272
 comparator, 705-7, 955
 op-amp, 856-60
 transfer characteristics, 856-7
 compilers, 14, 129, 447, 636-7, 1278
 described, 630
 operation, 636-7
 PROLOG, 663
 Complementary Metal Oxide Semiconductor (CMOS), *see* gates
 Computer Aided Design, *see* CAD
 Computer Aided Manufacturing (CAM), *see* graphics and industry

Computer Aided Print and Production, *see* CAP
 Computer Numerically Controlled (CNC), *see* industry
 conditioned loops and jumps, 5, 634
 conductance, 719-20
 conduction band, 117
 constant current generator, 469-70
 control bus, *see* busses
 control field, 1484, 1485-6
 control metaphors, *see* AI
 control signals, 1273-80
 control systems, *see* instrumentation and control systems
 conversion efficiency, 825-6
 convolution, 1299-1301
 CORAL-66, 497
 core, *see* memory
 corner frequency, 1093
 see also Bode plots
 coulomb, 187
 Coulomb's Law, 270
 counter, *see* flip-flops
 coupling coefficient, 458
 covalent bonds, 113
 CPU (Central Processing Unit), 4, 10-17, 1451
 accumulator register, 69
 adders, 67-9
 ALU, 67-70
 control unit, 67
 DMA (Direct Memory Access), 75

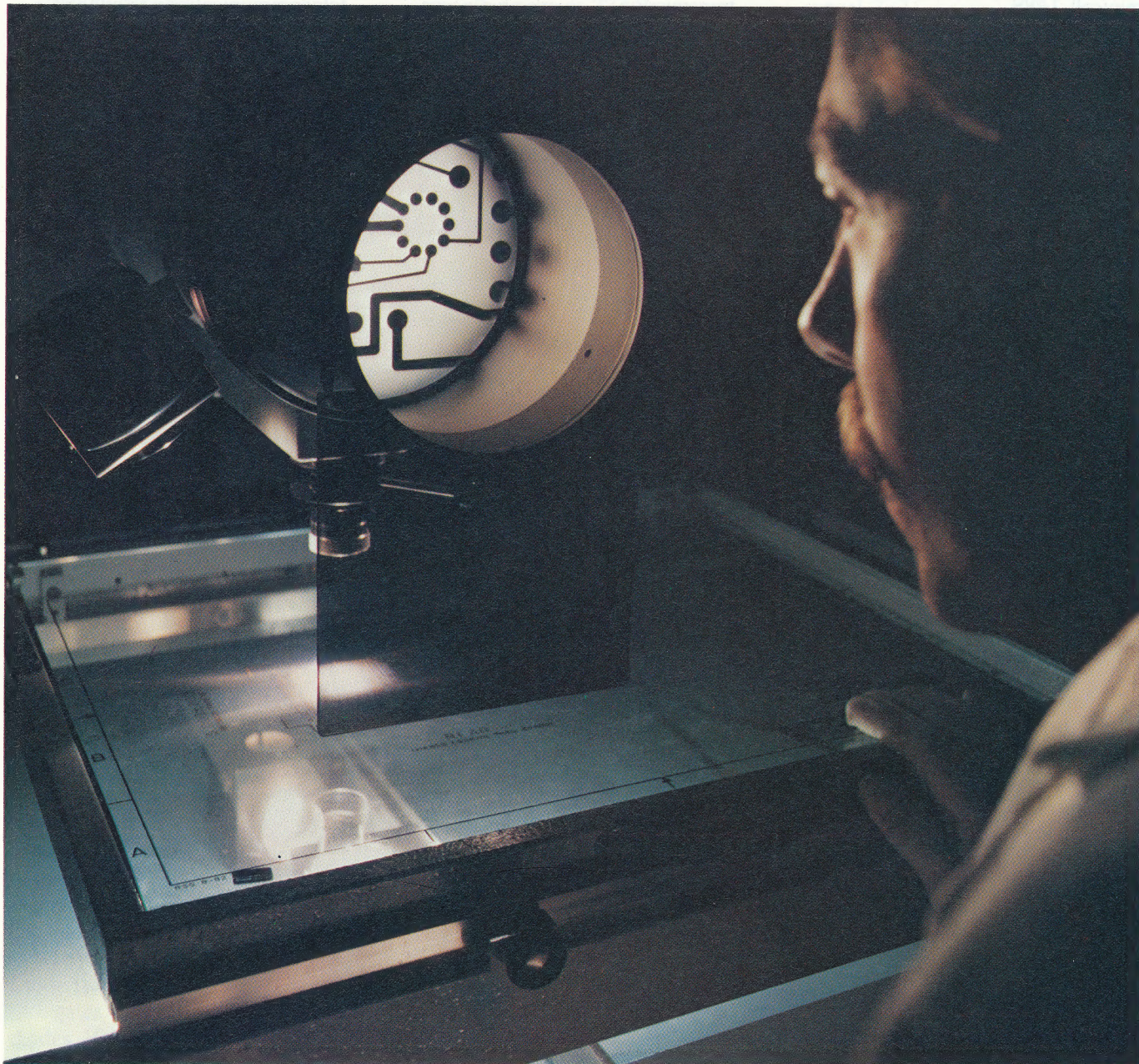


transfer, 268-9
 IR (Instruction Register), 134
 PC (Program Counter), 132
 registers, 67, 69
 reply signal, 67
 CRAG (Control and Row Address Group), *see* byte
 CRC (Cyclical Redundancy Check), 202, 1486
 Cross-Interleaved Reed-Solomon Code (CIRC), *see* compact disc
 cross-talk, 730, 757
 CRT (cathode ray tube), 666, 668, 691-7, 812, 1142
 colour, 695-7, 1031-4
 electron gun, 692-4, 696, 697
 facsimile systems, 1084
 graphics, 1215-19
 operation, 692
 oscilloscopes, 1060-6
 shadow mask, 1031
 spectrum analysers, 1144-50
 triad, 696, 697, 1031
 VDU, 835, 837
 CSMA/CD (Carrier Sense Multiple Access with Collision Detection), *see* LAN
 current, 17
 AC, 22
 symbol, 1577
 base, 396, 398
 bias, 396, 398
 collector, 301
 constant
 symbol, 1577
 drain, 421
 eddy, 533, 536
 gain, 919-20
 generator, 472
 holding, 561
 noise, 484
 offset, 679, 707
 parallel circuits, 718-20
 principal, 566
 quiescent, 397
 reverse gate, 421
 series circuits, 715-17
 short circuit, 768
 sink, 179
 source, 179
 symbols, 1577
 cursor, *see* VDU
 cut-off frequency, *see* corner frequency
 Cyclical Redundancy Check, *see* CRC

D

DAC (Digital-to-Analogue Converter), 673-83, 721-31, 1382
 applications, 721-31
 bipolar, 687-80
 quantisation, 680-1, 726-7
 R-2R ladder network, 676-8
 unipolar, 678-80
 weighted network, 674-6
 DAR (Direct Address Register), *see* registers
 Darlington pair, *see* transistors
 database, 650-64, 701-2
 administrator, 651, 652
 architecture, 652, 653-7
 data model, 652, 654
 hierarchical, 657-9
 root segment, 658
 security, 662
 segment occurrence, 658
 network, 657, 659
 CODASYL, 659
 security, 662
 set type, 659
 sub-schema, 662
 relational, 657, 659-61
 domains, 660
 normalised, 660-1
 tuples, 660
 sub-model, 654
 DBMS (Database Management System), 654, 656, 662, 663
 described, 651
 DSL (Data Sub-Language), 653-4
 entities, 651
 expert system, 650, 663
 IMS (Information Management System), 658
 independence, 652-3
 integrated, 651
 integrity, 652, 662-3
 key words, 652
 meta-data, 652
 operational data, 651
 primary key, 656
 program communications block (PCB), 662
 recovery routine, 663
 redundancy, 651
 security, 652, 661-3, 835
 stored record, 652-3
 user interface, 654
 Database Management System (DBMS), *see* database
 data bus, *see* busses
 data capture, 837-8
 key-to-store, 837
 MICR, 838
 OCR, 838
 touch-screen, 838
 beam-cutting, 838
 capacitive, 838
 Data Circuit terminating Equipment (DCE), *see* data transmission
 Data Encryption Algorithm (DEA), *see* security: cryptography
 data files, *see* memory
 datagrams, 1428
 data networks, 1499-1500, 1517-21
 common carriers, 1518
 development, 1517-21
 PABX, 1535-6
 transceiver, 1541-2
see also LAN;
 telecommunications; WAN
 data processing, 3, 4
 acknowledgement, 269
 back-up, 268
 batch, 523, 582-92
 binary search, 317-18
 control block, 582, 583, 589
 file directory, 583
 flagging, 589
 global variables, 589
 hold, 269
 information nodes, 1051
 multiprocessing, 66, 589
 non-destructive read, 1154-5
 parallel data transfer, 7, 190
 polling, 267-8, 1564
 protocol (handshaking), 267-8, 1171, 1441-8, 1483-90
 queue, 268, 309
 race condition, 591
 recirculate, 570
 resource management, 582-92
 round-robin, 583
 search key, 317
 sequential search, 317
 serial data transfer, 7, 190, 462
 service priority, 268
 spooling, 583
 stacks, 309, 637
 state vector, 589

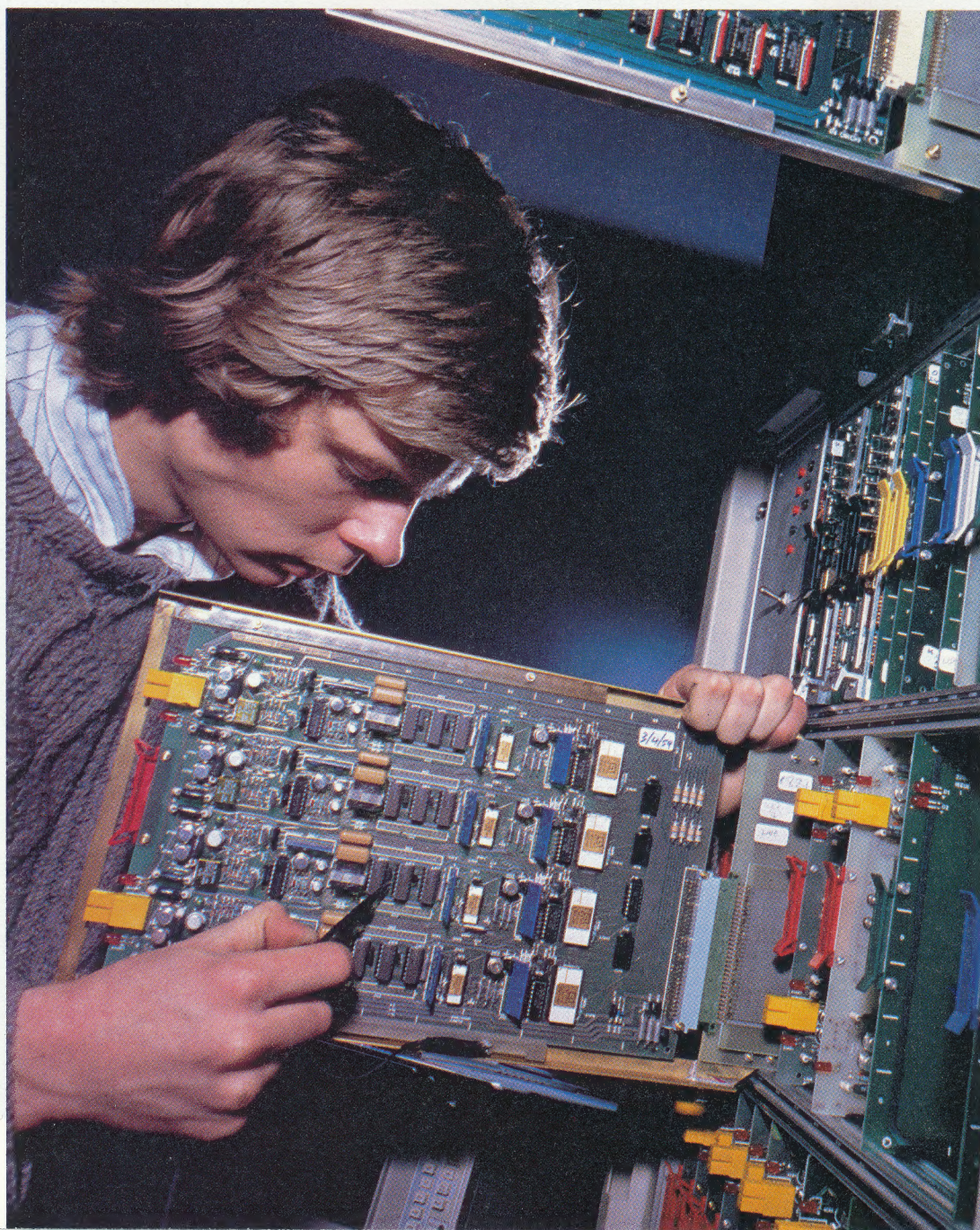
- system dead-lock, 591-2
- test and set, 591
- wait state, 583
- write enable line, 569-70
 - see also* data structures;
medicine; memory; office
technology
- data protection, *see* security
- data sheet, 177
- data structures, 308-20, 363-4, 703
 - arrays, 309-14
 - chained, 314-15
 - charts, 310
 - elements, 308
 - field, 308
 - FIFO, 309
 - FILO, 370
 - fixed length list, 309
 - LIFO, 309
 - linear list, 309
 - network, 315-16
 - nodes, 310, 311
 - path, 310
 - queues, 309
 - set, 309
 - sides, 310
 - stacks, 309
 - tables, 310, 316-18
 - variable length list, 309
 - vector, 309-10, 312-14
 - see also* data processing and
memory
- Data Sub-Language (DSL), *see*
database
- Data Terminal Equipment (DTE), *see*
data transmission
- data transmission, 1336-44, 1372-84,
1483-90
 - bit stuffing, 1484-5
 - capacity, 1337
 - CCITT standards, 1340, 1375,
1377-8, 1380-2, 1441-8,



1483-90, 1559
coding, 1337-44
data signalling rate, 1338
DCE, 1373, 1441-8, 1483-90
DTE, 1373, 1375, 1377-8,
1379-83, 1402, 1428, 1441-8,
1483-90, 1537-44
duplex, 1340, 1375
fields, 1484-90
frames, 1484-90
half-duplex, 1340, 1375
handshaking, 1379-83
interchange circuits, 1379-83
logical channel, 1487
minicall, 1488

modulation rate, 1338
PABX, 1535-6
packets, 1487-90
simplex, 1340
V-Series, 1340, 1375, 1377-8,
1380-2, 1441, 1442, 1559
X-Series, 1441-8, 1483
see also telecommunications
DBMS (Database Management
System), *see* database
DBS (Direct Broadcast Satellite),
see satellite communications
DCE (Data Circuit terminating
Equipment), *see* data
transmission

DCO (Digitally Controlled
Oscillator), *see* oscillators
DCTL (Direct Coupled Transistor
Logic), *see* gates
De Morgan's laws, 246
debugging, *see* bug
DEA (Data Encryption Algorithm),
see security: cryptography
decibels, 1093-9
decimal point digit, 932
decoders, 240-53, 274-95
decryption, *see* security:
cryptography
demodulator, *see*
telecommunications: telephone



demonstrator, *see* programs and programming
 demultiplexer, 289, 340, 883
 derating, 992
 development systems, 1437
 DI (Disable Interrupt), *see* interrupt
 diac (Diode Alternating Current), 599-600
 symbol, 1576
 dibit, *see* bit
 DI/CMOS (Dielectrically Isolated CMOS), *see* gates: CMOS
 dielectric, 205-7
 relative permittivity, 206
 strength, 559-60
 Dielectrically Isolated CMOS (DI/CMOS), *see* gates: CMOS
 differential amplifier, 53
 differential drain resistance, 421
 digital computer
 fifth generation, 11, 1001-7, 1460
 first generation, 7-8, 1001
 fourth generation, 10-11, 1001
 parallel, 1002
 principles, 1246-59
 second generation, 8-9, 1001
 third generation, 8-10, 1001
 digital filters, 1430-3
 FIR, 1430-3
 high-pass, 1433
 non-recursive, 1432
 output, 1433
 voltage sampling, 1430
 digital meters, 1057-9
 digital multiplier, 1432
 digital signals, 1070-4, 1192-1206
 Digital Speech Interpolation (DSI), *see* satellite communications
 Digital Storage Oscilloscope (DSO) *see* oscilloscopes: storage
 digital systems
 accuracy, 387-8
 addition, 921-3
 advantages, 387-90
 control signals, 932
 limitations, 387-94
 speed, 388, 392-4
 digital thermometer, 726
 Digital-to-Analogue Converter, *see* DAC
 Diode Transistor Logic (DTL), *see* gates
 diodes, 109, 154-9, 220-33
 behaviour, 165

clamping, 110-11, 233
 crystal, 110-11
 detectors, 110, 232-3
 integrated, 412-13
 limiting circuit, 222-5
 photodiode, 665
 avalanche, 669
 p-i-n diode, 667
 symbol, 1576
 rectifiers, 52, 109
 full-wave bridge, 1012, 1013
 symbol, 1576
 Schottky, 176
 symbol, 1576
 smoothing circuit, 227-8
 stabilised supply, 224, 229-30
 symbol, 1576
 Zener, 168, 170, 229-30
 symbol, 1576
 Dirac function, 1243
 Direct Access Registers (DAR), *see* registers
 direct addressing, 130
 see also registers: DAR
 Direct Broadcast Satellite (DBS), *see* satellite communications
 Direct Coupled Transistor Logic (DCTL), *see* gates
 Direct Memory Access (DMA) *see* CPU
 Disable Interrupt (DI), *see* interrupt
 disks, *see* memory
 display register, *see* registers
 distributed control, 1540
 DMA (Direct Memory Access), *see* CPU
 document formatters, 892
 domains, *see* electromagnetism
 doping, 59, 116-18
 down time, 8
 drift, 1050
 DSI (Digital Speech Interpolation), *see* satellite communications
 DSL (Data Sub-Language), *see* database
 DSO (Digital Storage Oscilloscope), *see* oscilloscopes: storage
 DTE (Data Terminal Equipment), *see* data transmission
 DTL (Diode Transistor Logic), *see* gates
 dynamic drain resistance, 490
 dynode, 668

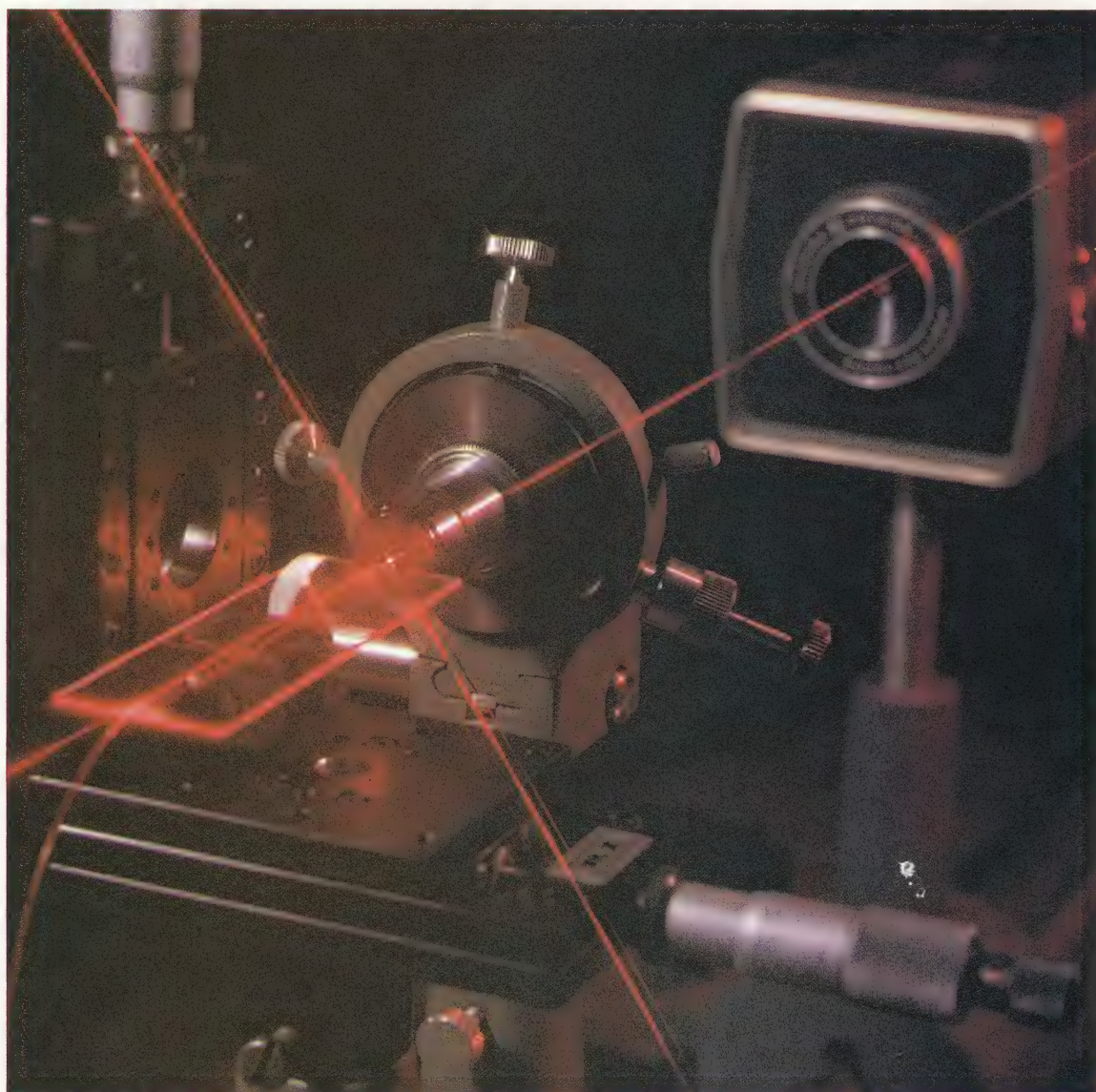
E

EAN (European Article Numbering), *see* bar code
 EAROM (Electrically Alterable Read Only Memory), *see* memory
 earth
 chassis/frame connection, 53
 GND, 53
 symbols, 1577
 virtual, 737
 EBCDIC (Extended Binary Coded Decimal Interchange Code), 40
 ECL (Emitter Coupled Logic), *see* gates
 ECS (European Communications Satellite), *see* satellite communications
 eddy current, *see* current
 education, 1104-14
 drill and practise, 1108
 instruction support, 1109
 management, 1104-7
 PLATO, 1106-7, 1109
 simulations, 1110-14
 tutorials, 1109
 EEG (ElectroEncephaloGraph), *see* medicine
 E²PROM, *see* memory: EEPROM
 EEPROM (Electrically Erasable Programmable Read Only Memory), *see* memory
 Effective Isotropic Radiated Power, *see* EIRP
 Effective Radiated Power (ERP), *see* EIRP
 efficiency, 152-3
 EFT (Electronic Funds Transfer), *see* banking and commerce
 EHT (Extra High Tension), 230
 EI (Enable Interrupt), *see* interrupt
 EIRP (Effective Isotropic Radiated Power), 1238, 1239
 Electrically Alterable Read Only Memory (EAROM), *see* memory
 Electrically Erasable Programmable Read Only Memory (EEPROM), *see* memory
 ElectroEncephaloGraph (EEG), *see* medicine
 electroluminescence, 622

electromagnetism, 237-9, 272-3
domains, 239, 332-4
ferromagnetic materials, 329, 332-4
fields and flux 187, 237, 270-1,
272-3, 329-31, 332-4, 375-7,
402-5, 454-6, 457-8, 493-6,
533-5, 536-7
induction, 188, 239, 424-7, 454-6,
457-8, 556-8, 559-60, 684-6
magnetic flux and permeability,
329-31, 332-4
magnetisation characteristic, 332
MMD, 535
MMF, 273
moment/torque, 332
mutual inductance, 457-8
permeability, 329-31, 332-4
reluctance, 375-7

remanence, 334
screening, 804-5
self-inductance, 454-6
solenoid, 238-9
toroid, 272
see also EMF
ElectroMotive Force, *see* EMF
electron gun, *see* CRT
electron microscope, 1332
electronic filing, *see* office technology
Electronic Funds Transfer (EFT), *see*
banking and commerce
electronic mail, *see* office technology
Electronic News Gathering (ENG),
see telecommunications:
television
Electronic News System (ENS), *see*
telecommunications: television

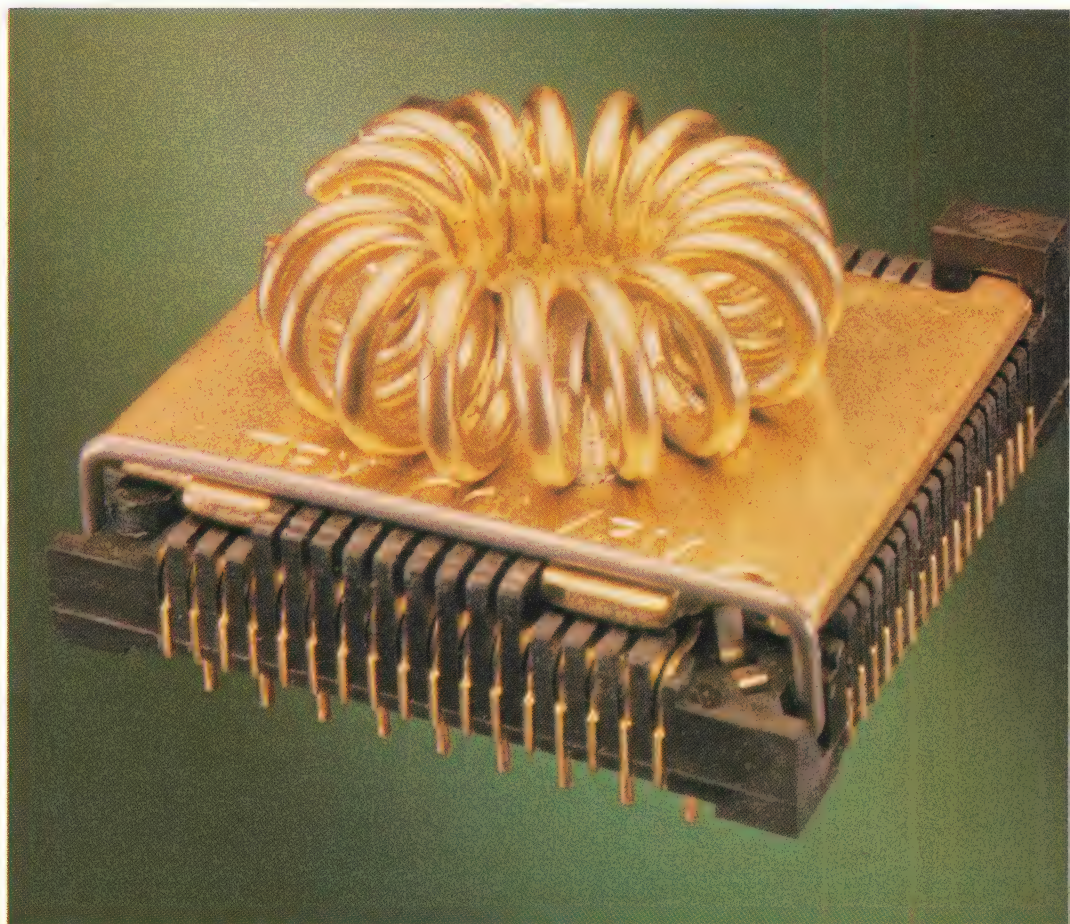
electronic payment services, *see*
banking and commerce
electrons, 58, 82
electronvolts, 117
flow, 164-5
EMF (ElectroMotive Force), 82-3,
150, 493-6
Emitter Coupled Logic (ECL), *see*
gates
Enable Interrupt (EI), *see* interrupt
encryption, *see* security: cryptography
end-around loop, 1156
End Of Conversion signal (EOC), *see*
sample-and-hold
energy, 152-3, 270-1
conservation, 185
conversion, 533-5, 536-7
dissipation, 334



kinetic, 152-3
 potential, 152
 storage, 271, 456
 ENG (Electronic News Gathering),
 see telecommunications:
 television
 ENIAC (Electronic Numerical
 Integrator and Calculator), 6
 ENS (Electronic News System), *see*
 telecommunications: television
 EOC (End Of Conversion signal), *see*
 sample-and-hold
 EPROM (Erasable Programmable
 Read Only Memory), *see*
 memory
 equalisers, 1302
 equivalent circuit, 467
 dynamic, 473
 large-signal, 473
 small-signal, 473
 Erasable Programmable Read Only
 Memory (EPROM), *see* memory
 ergonomics, 903
 ERP (Effective Radiated Power), *see*
 EIRP
 error, *see* reliability
 ESPRIT (European Strategic Program
 on Research in Information
 Technology), *see* IT
 Ethernet, *see* LAN
 Euronet, *see* WAN
 European Article Numbering (EAN),
 see bar codes
 European Communications Satellite
 (ECS), *see* satellite
 communications
 European Strategic Program on
 Research in Information
 Technology (ESPRIT), *see* IT
 EUROpean TELEcommunications
 SATellite (EUTELSAT), *see*
 satellite communications
 EUTELSAT (EUropean
 TELEcommunications
 SATellite), *see* satellite
 communications
 event counter, 1137-43
 EXclusive OR (XOR) gate, *see* gates
 executive, *see* operating system
 EXOR gate, *see* gates: XOR
 Extended Binary Coded Decimal
 Interchange Code, *see* EBCDIC
 external alphabet, 130
 Extra High Tension, *see* EHT

F

Fabry-Perot interferometer, 1460
 facsimile systems (fax), 891, 896,
 1075-92, 1117-36
 bandwidth, 1130-2
 baseband signal, 1077, 1117-20
 described, 1075-8
 development, 1076-7
 encoding, 1132-6
 floodlighting, 1081-4
 LIS (Linear Image Sensor), 1091
 operation, 1079-80
 PAM, 1118
 printing, 1121-5
 resolution, 1084, 1126-30
 scanning, 1084-92, 1117-20,
 1126-30
 spotlighting, 1081-4
 failure, *see* reliability
 Fairlight Computer Musical
 Instrument, *see* music
 fall time, *see* transistors
 farad, 205-7
 Faraday cage, 188
 fax, *see* facsimile systems
 FCC (Federal Communications
 Commission, U.S.), 1135,
 1517-18
 FCS (Frame Check Sequence) field,
 1484-90
 FDM (Frequency Division
 Multiplexing), *see* multiplexers
 FDMA (Frequency Division Multiple
 Access), *see* satellite
 communications
 Federal Communications
 Commission (U.S.), *see* FCC
 feedback, 735-47, 766-8
 frequency dependent, 740-1
 negative, 389, 552, 735, 736, 766
 positive, 735, 742-7
 FET (Field Effect Transistor), *see*
 transistors
 fetch, 134



fibre optics, *see* optical fibres
 Field Effect Transistor (FET), *see* transistors
 fields, *see* electromagnetism
 FIFO (First In/First Out), *see* data structures
 file manager, 592
 film, *see* graphics
 FILO (First In/Last out), *see* data structures
 filters, *see* analogue filters and digital filters
 Finite Impulse Response (FIR) filter, *see* digital filters
 FIR (Finite Impulse Response) filter, *see* digital filters
 firmware, 12
 First In/First Out (FIFO), *see* data structures
 First In/Last Out (FILO), *see* data structures
 fixed control, *see* programs and programming: hard-wired control
 flag register, *see* registers
 flags, 67
 borrow, 1291
 carry, 67, 1291
 field, 1484-90
 overflow, 1291
 parity, 67
 sign, 67, 1290-1
 zero, 67, 1290-1
 Fleming's rules
 left-hand, 402
 right-hand, 493, 494
 flip-flops, 459-66, 475-82, 509-19
 asynchronous, 459
 bistable, 461
 clock, 459
 condition code, 1294
 counter, 478-82, 513-19, 1137-43
 asynchronous, 478-9
 direct-gated, 1139
 event, 1137-43
 frequency, 1137-43
 heterodyning, 1140-1
 modulus, 481, 513
 multiplying, 1140
 oscillators, 1142
 prescaler, 1140
 reciprocating gated, 1140
 ripple, 479
 synchronous, 459, 480-2
 time, 1137-43

types, 1141-2
 D-type, 476
 J-K, 474-7, 480
 level-triggered, 477, 510
 master-slave, 464-6
 negative-edge triggered, 466, 478, 510
 overflow, 1291
 positive-edge triggered, 477-8, 510
 R-S, 460, 475
 T-type, 476, 478, 479
 flowcharts, *see* programs and programming
 flux, *see* electromagnetism
 FM (Frequency Modulation), 22
 described, 382-3
 FSK, 1341
 FORTRAN (FORmula TRANslation), 13, 506-7, 1436, 1567
 Fourier
 series, 1162-5, 1175-7, 1332, 1336-7, 1491
 transform, 1148
 Frame Check Sequence field, *see* FCS
 frame connection earth, *see* earth
 frequency
 changer, 1036
 compensation, 722
 counter, 1137-43
 cut-off, 389
 equivalent, 1131
 impedance, 687-90
 response, 946-9, 1093-9, 1243-5
 satellite, 1186-9
 Frequency Division Multiple Access (FDMA), *see* satellite communications
 Frequency Division Multiplexing (FDM), *see* multiplexers
 frequency domain, 1144
 Frequency Modulation, *see* FM
 frequency response, *see* Bode plots
 Frequency Shift Keying (FSK), *see* telecommunications: telephone
 FSD (Full Scale Deflection), 746, 1010-16
 FSK (Frequency Shift Keying), *see* telecommunications: telephone
 Full Scale Deflection, *see* FSD
 full-wave bridge rectifiers, *see* diodes: rectifiers
 function tables, 97-100
 fuses
 symbols, 1577

G

GADS (Gate Array Design System), *see* gates: arrays
 gain, 53
 closed loop, 735
 mid-band, 771
 open loop, 735
 gain bandwidth product, 738
 gain control, 53-4
 games, *see* AI
 gap, 367
 Gate Array Design System (GADS), *see* gates: arrays
 Gate Turn-Off thyristor (GTO), *see* thyristor
 gates, 11-12
 AND, 65
 symbol, 1576
 AND-OR-INVERTER, 274
 arrays, 861-74
 CMOS, 136, 145-7, 208-19
 DCTL, 136, 139-40
 DTL, 136, 140, 147
 ECL, 136, 142, 147
 fan-in, 138
 fan-out, 138
 I²L, 136, 142-3, 147
 inverter, 96
 MOSFET, 143-7
 NAND, 98-100
 symbol, 1576
 NMOS, 136, 144-5, 147
 noise margin, 138
 NOR, 99
 symbol, 1576
 NOT, 65
 symbol, 1576
 OR, 65, 91-3
 symbol, 1576
 power dissipation, 138-9
 propagation delay time, 138
 ripple, 137
 RTL, 136, 139
 Schmitt trigger
 symbol, 1576
 sum-of-products circuit, 283
 symbols, 1576
 threshold voltage, 137
 transfer characteristic, 136, 137
 TTL, 136, 140-2, 147, 172-83



- WIRED-AND, 182
 XOR, 70, 345-8
 symbol, 1576
 see also busses; decoders;
 flip-flops; latches; registers
 gateways, 842
 gating, 105
 General Format Identifier, *see* GFI
 General Problem Solver (GPS), *see*
 AI: control metaphors
 generator polynomial, 1486
 GFI (General Format Identifier), 1487
 Gibbs phenomenon, 1165
 Gilbert cell, 858, 859
 glitch, 1116
 GND, *see* earth
 GPS (General Problem Solver), *see*
 AI: control metaphors
 graphics, 266, 384, 1215-19, 1403-14
 advantages, 1403-4
 applications, 1407-11
 bit mapped image, 1405
 CAD, 1407-8, 1412
 CAM, 1407-8, 1414
 development, 1404
 film, 1409-10
 market, 1412-14
 medicine, 1411
 Quantel, 1409
 simulation, 1410-11, 1414
 software, 1407, 1412
 system, 1405-7
 tablet, 1406
 television, 1409-10
 thermography, 1411
 three-dimensional, 1408
 vector scan, 1405
 'wire diagram', 1410
 workstation, 1405-7
 graticule, *see* oscilloscopes
 Gray code, 20, 40
 GTO (Gate Turn-Off thyristor), *see*
 thyristor

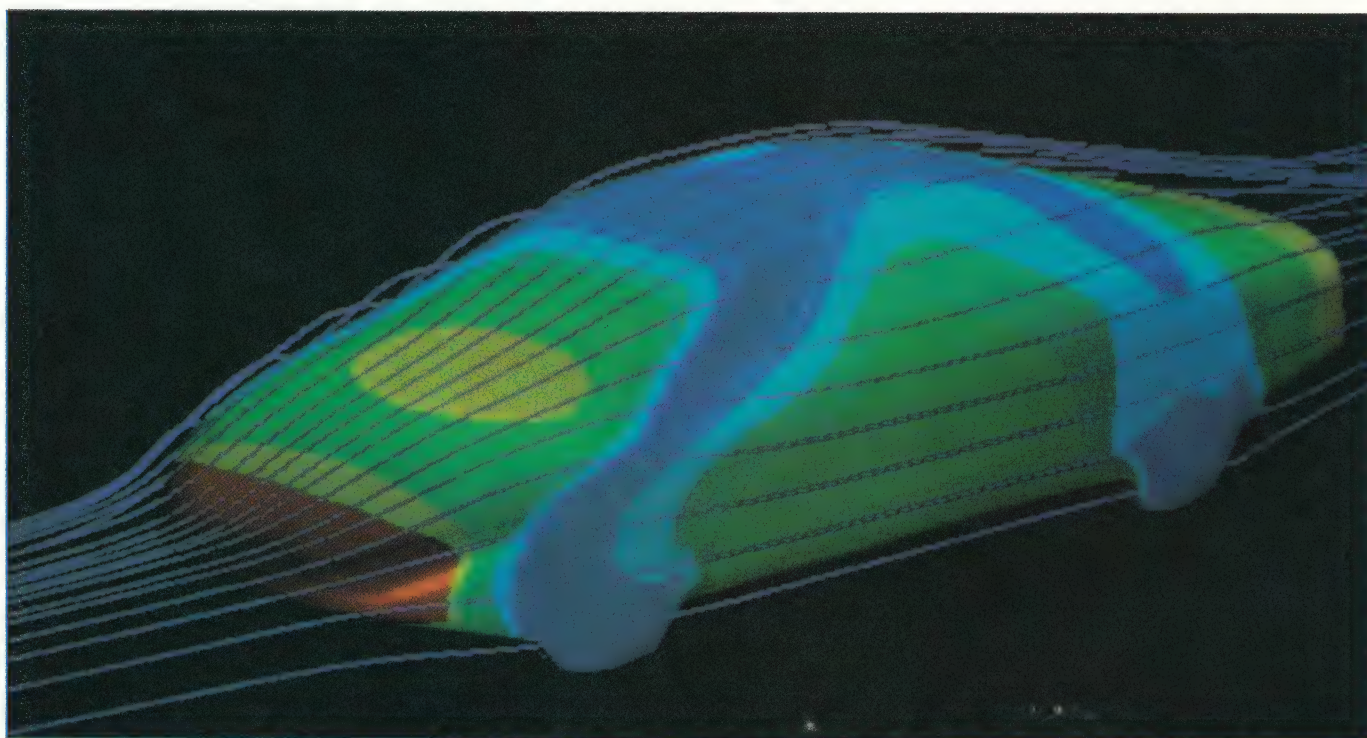
H

- hairpin loop, 646
 half-adder, 346
 Hamming code, 1557
 handshaking, *see* data processing:
 protocol
 hardware, 4
 components, 60-75
 Hardware Description Language
 (HDL), *see* gates: arrays
 hard-wired control, *see* programs and
 programming
 harmonic response locus, *see* Nyquist
 plot
 HDL (Hardware Description
 Language), *see* gates: arrays
 HDTV (High Definition Television),
 see telecommunications:

television
 head end, 1541, 1584
 health, *see* medicine
 help message, *see* programs and programming
 Henry, 455
 hexadecimal number system, 41, 123-6
 High Definition Television (HDTV), *see* telecommunications:
 television
 High Power Amplifiers (HPA), *see* amplifiers
 hole, 114
 Hollerith, Hermann, 6
 code, 20
 home technology, 759-64
 electronic letterbox, 762
 telephone, 762, 763
 teletext, 761-2
 viewdata, 762
 HPA (High Power Amplifiers), *see* amplifiers
 Huffman code, 1133
 hum, 757
 hunting, *see* instrumentation and control systems
 hybrid circuits, 9, 428-36
 hysteresis, 755-6
 hysteresis loop, 333-4
 hysteresis loss, 534

IAB (Indirect Address Buffer), 1346
 IAR (Indirect Address Register), *see* registers
 IBG (Inter-Block Gap), 367
 see also memory
 IC (Integrated Circuit), 9, 10, 26, 136, 1297, 1332
 density, 11-12, 172, 406, 410, 1562
 development, 1495-7
 gate arrays, 861-9
 hybrid, 428-36
 compared with monolithic, 435-6
 structure, 428
 thick-film, 429-36
 thin-film, 429,
 manufacture, 224, 406-16, 428-36
 monolithic, 173, 406-16
 compared with hybrid, 435
 PLA (Programmable Logic Array), 861, 869-74
 power amplifier, 831-2
 reliability, 406, 435
 size, 1495-7
 testing, 1378
 transputer, 1495-6

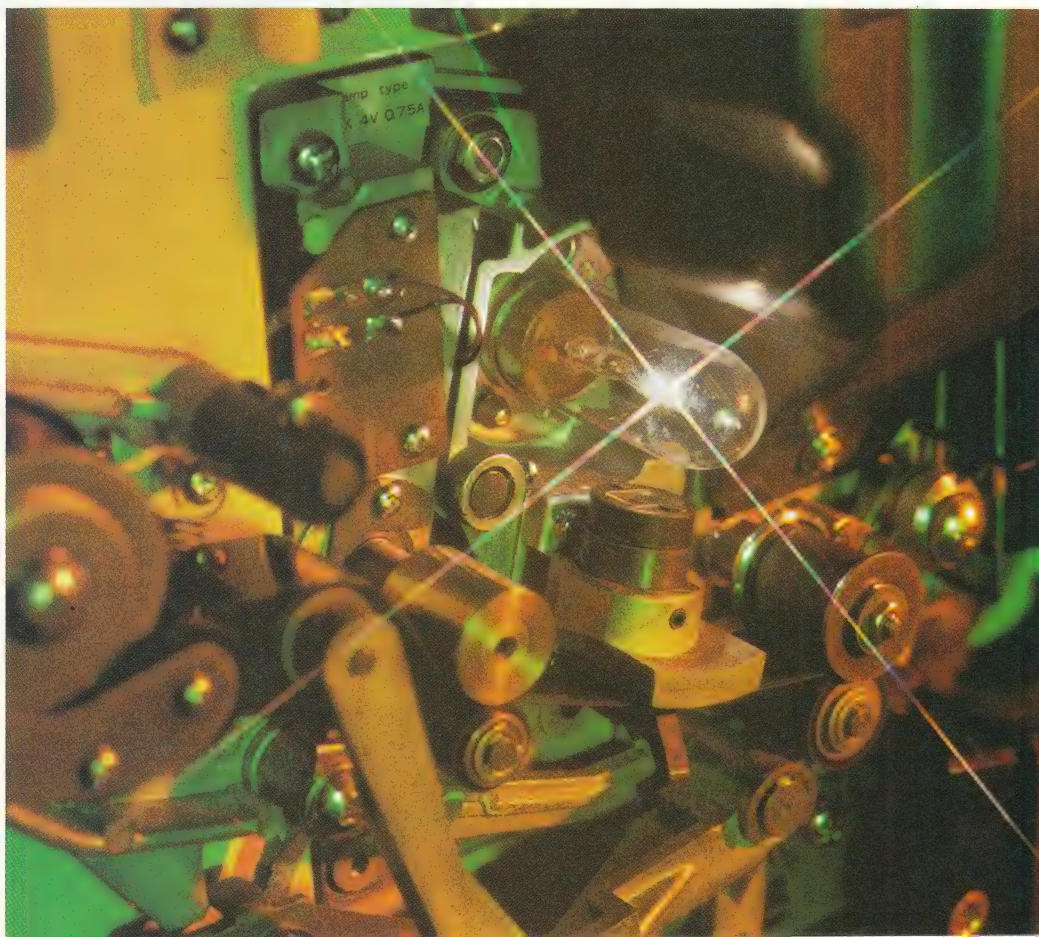
wire bonding, 1437, 1439
 icons, 903, 1406
 ICOT (Institute for new generation COmputer Technology, Japan), 1003
 IDA (Integrated Digital Access), 1520-1
 idle routine, *see* routine
 IEC (International Electrotechnical Commission), 743-4
 IGFET (Insulated Gate Field Effect Transistor), *see* transistors: FET
 I²L (Integrated Injection Logic), *see* gates
 IKBS (Intelligent Knowledge-Based Systems), *see* AI
 images, *see* graphics
 immediate addressing, 129
 impedance, 688-90, 718-20
 complex, 781
 op-amp, 767-8
 impulses, 1243-5, 1299-1301
 IMS (Information Management System), *see* database
 indexing, *see* memory
 Indirect Address Buffer, *see* IAB
 Indirect Address Register (IAR), *see* registers
 induction, *see* electromagnetism
 industry 1111-12, 1207-23
 assembly, 1221-2



CAD, 1215-19
 CAM, 1219-23
 CNC, 1219-23
 group technology, 1222
 integration, 1223
 process control, 1210-15, 1366
 production control and planning, 1207-8
 quality control, 1220-1
 stages, 1208, 1209-10
see also AI
 informatics, *see IT*
 information field, 1484-90
 Information Management System (IMS), *see database*
 Information Technology, *see IT*
 INMARSAT (INternational MARitime SATellite), *see satellite communications*
 Input/Output unit, *see I/O*
 instruction cycle, 33
 Instruction Register (IR), *see registers*
 instruction set, *see microprocessor*
 instrumentation and control systems, 752-8, 783-93
 closed-loop control, 789
 cruise control, 787-92
 decay factor, 790
 feedforward control, 788-9
 hunting, 789
 integral control, 790
 natural frequency, 790
 open-loop control, 787-8
 PI (Proportional-Integral) control, 790
 proportional control, 789-90
 time constant, 790
 Insulated Gate Field Effect Transistor (IGFET), *see transistors: FET*
 Integrated Circuit, *see IC*
 Integrated Digital Access, *see IDA*
 Integrated Injection Logic (I^2L), *see gates*
 Integrated Services Digital Network *see ISDN*
 Integrated Services PABX (ISPABX), *see telecommunications: telephone*
 integrators, *see op-amp*
 Intelligent Knowledge-Based Systems (IKBS), *see AI*
 INTELSAT (INternational TELEcommunications SATellite organisation), *see satellite communications*

Inter-Block Gap (IBG), *see memory*
 interference, 756-7
 intermediate sum, 955
 International Electrotechnical Commission, *see IEC*
 INternational MARitime SATellite (INMARSAT), *see satellite communications*
 International Packet Switching Service (IPSS), *see telecommunications: telephone*
 International Radio Consultative Committee, *see CCIR*
 International Standards Organisation *see ISO*
 INternational TELEcommunications SATellite organisation (INTELSAT), *see satellite communications*
 International Telegraph and Telephone Consultative Committee, *see CCITT*
 INTERNIST, *see medicine*
 interpreter, 447, 636-7
 described, 630
 Inter-Record Gap, *see IRG*
 interrupt, 1249, 1276
 DI (Disable Interrupt), 1472
 EI (Enable Interrupt), 1472,

1479, 1481
 inverse square law, 270
 inversion layer, 487
 inverter, *see gates*
 I/O (Input/Output) unit, 4, 254-69
 ions, 155
 IPSS (International Packet Switching Service), *see telecommunications: telephone*
 IR (Instruction Register), *see registers*
 IRG (Inter-Record Gap), 367
see also memory
 ISDN (Integrated Services Digital Network), 1521
 ISO (International Standards Organisation) code, 131, 1443, 1445-7, 1483-90
 ISPABX (Integrated Services PABX), *see telecommunications: telephone*
 IT (Information Technology), 3, 764, 1493-1504
 applications, 1499, 1501-4
 described, 1493-5
 development, 1495-1500
 informatics, 1494
 telematics, 1494



J

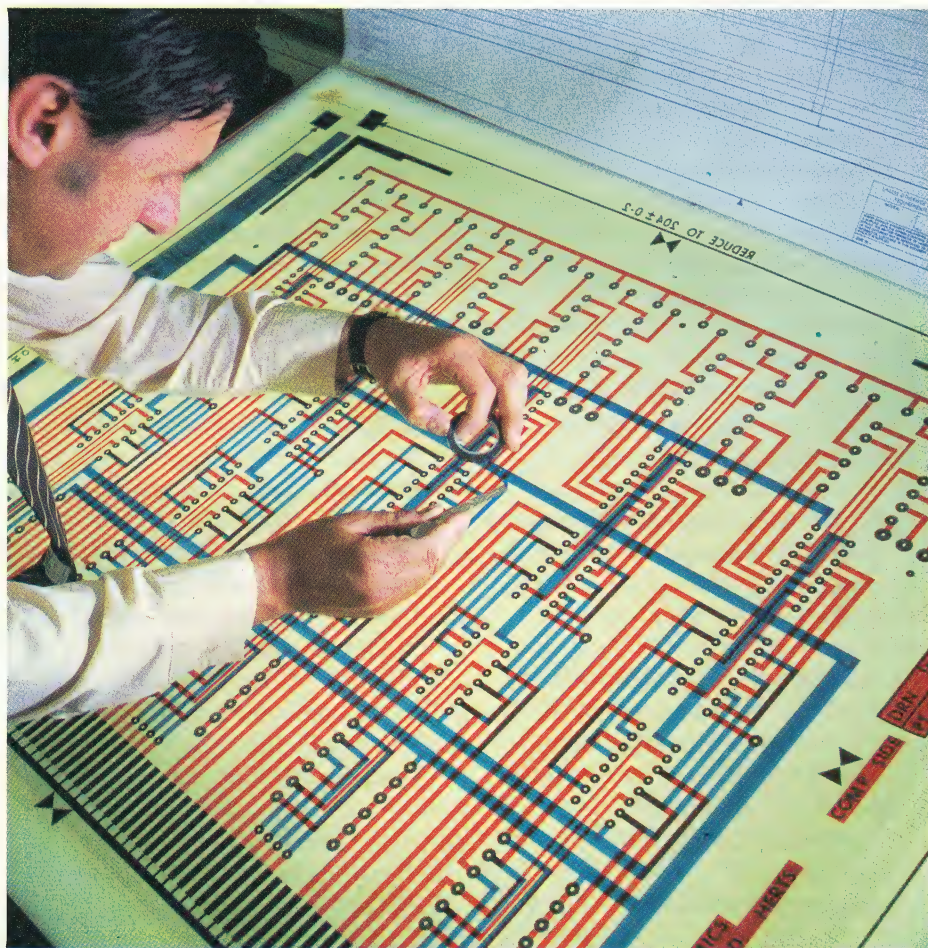
JCL (Job Control Language), *see* language
 JFET (Junction Field Effect Transistor), *see* transistors: FET
 Job Control Language (JCL), *see* language
 job manager, 582-4
 Josephson junction, 1452-3, 1460
 journalism, *see* publishing and telecommunications: television
 joystick, 265, 1217
 Junction Field Effect Transistor (JFET), *see* transistors: FET

K

Karnaugh map, 249, 282-3
 Kennelly-Heaviside layer, 802
 keybounce, 1480
 KiloStream, 1520
 Kirchhoff's laws, 184-5, 779-81
 klystron, *see* amplifiers
 knee, 166
 knowledge engineer, 968

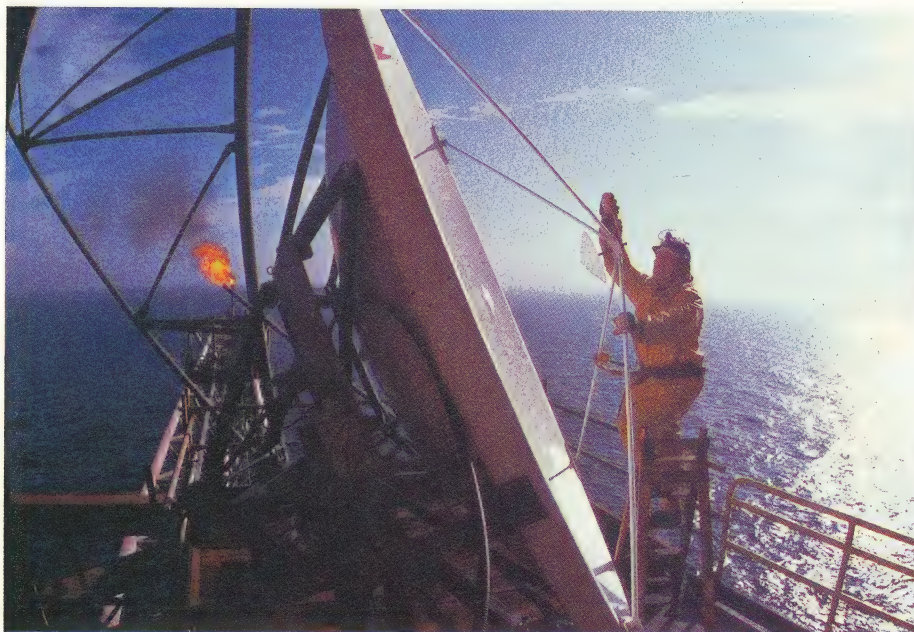
L

laminations, 533
 lamp test, 290
 lamps
 symbol, 1577
 LAN (Local Area Network), 1499-1500, 1519, 1537-44
 access, 1539, 1541-2
 CSMA/CD, 1541-2
 token/baton passing, 1542-3



Cambridge ring, 1499-1500, 1519, 1542-3, 1544
 circuit switched, 1537-8
 described, 1537-8
 Ethernet, 1500, 1519, 1541
 formats, 1539-41
 non-switched, 1537-8
 packet switched, 1437-8
 topologies, 1537, 1539-41
 broadcast bus, 1540-1, 1544
 ring, 1540, 1541, 1544
 star 1539-40
 tree, 1541
 transmission medium, 1544
 types, 1537-8
 language, 13-14, 15, 121-35, 442, 497-508, 1278-80, 1434-7
 BNF (Backus Naur Form), 638-9
 'friendly', 446, 498, 502
 high level, 497, 1436, 1567
 intermediate, 636
 JCL (Job Control Language), 524
 low level, 497
 machine, 497
 meta language, 638

natural, 970-3
 RPN (Reverse Polish Notation), 639-40
 types, 442, 497
 see also alphanumeric codes; assembler; BASIC; COBOL; CORAL-66; FORTRAN; interpreter; OCCAM; PASCAL; PL/1; translator
 Large Scale Integration, *see* LSI
 laser, 618, 625-6, 1262, 1264
 bar code, 1262
 compact disc, 392, 763, 1268-72
 data storage, 1460
 disk, 712
 facsimile systems, 1089, 1120
 optical fibres, 1286, 1287
 optical recording, 839-40
 short wavelength, 1287
 Last In/First Out (LIFO), *see* data structures
 latch, 43, 459
 asynchronous, 459
 clocking, 459
 complemented output, 459



condition, 958
 cross-coupling, 460
 timing diagrams, 460, 462
 transparent, 459-60
 see also flip-flops; gates;
 registers
 LCD (Liquid Crystal Display)
 multimeters, 1059
 operation, 624
 telephone, 764
 VDU, 835
 LCGN (Logical Channel Group
 Number), 1487
 learning, *see* education
 Least Recently Used strategy (LRU),
 see operating system
 Least Significant Bit (LSB), *see* bit
 Least Significant Digit (LSD), *see*
 binary number system
 LED (Light Emitting Diode), 28-32,
 78, 619, 621-3, 1264
 alphanumeric display, 30, 31
 bar code, 1264, 1268
 gallium arsenide, 805
 infra-red, 1287
 logic state indicator, 28, 29
 multimeters, 1059
 operation, 622-3
 optical characteristics, 623
 optical fibre, 1283, 1286, 1287
 pseudo-ASCII, 1507
 short wavelength, 1287
 symbol, 1576
 types
 Lenz's law, 427

light, 617-20, 621-6, 665-72, 1260-72
 angle of incidence, 1282
 critical angle, 1283
 destructive interference, 1089
 guide, 1283
 intensity, 1260-2
 reflection, 1281-3
 angle, 1282
 internal, 1283
 refraction, 1281-3
 angle, 1282
 index, 1282
 Snell's law, 1282-3
 sensors, 617, 665-72, 1080-92
 1264, 1473, 1474
 Darlington, 1474
 types, 1264
 sources, 621-6, 1262-4, 1285,
 1287
 see also optoelectronics
 Light Emitting Diode, *see* LED
 light-pen, 263, 384, 431, 940, 1217,
 1222
 Linear Image Sensor (LIS), *see*
 facsimile systems
 Linear Predictive Coding (LPC), *see*
 voice synthesis
 lips (Logical Inferences Per Second),
 1003
 Liquid Crystal Display, *see*
 LCD
 LIS (Linear Image Sensor), *see*
 facsimile systems
 LNA (Low Noise Amplifier), *see*
 amplifiers

load line, 220
 Local Area Network, *see* LAN
 location, *see* address
 logic analysers, 1115
 logic board, 90
 logic gate, *see* gates
 logic state indicator, 28, 29
 Logical Channel Group Number, *see*
 LCGN
 logical sum/product, *see* binary
 number system
 loudspeaker, 537
 symbol, 1577
 Low Noise Amplifier (LNA), *see*
 amplifiers
 LPC (Linear Predictive Coding), *see*
 voice synthesis
 LRU (Least Recently Used strategy),
 see operating system
 LSB (Least Significant Bit), *see* bit
 LSD (Least Significant Digit), *see*
 binary number system
 LSI (Large Scale Integration), 11,
 91, 107, 109, 172, 1451
 lumen, 1261
 luminescence, 622, 692
 lux, 1261

M

machine code, 121-35
 machine language, *see* language
 macro instruction, 635
 see also assembler
 magnetic core, *see* memory
 magnetic disk, *see* memory: disks
 Magnetic Ink Character Reader, *see*
 MICR
 magnetic tape, *see* memory: tape
 magnetism, *see* electromagnetism
 MagnetoHydroDynamic generation
 (MHD), *see* electromagnetism
 MagnetoMotive Force (MMF), *see*
 electromagnetism
 majority carrier, 118
 man-machine interface, 1004
 MARECS (MARitime European
 Communications Satellite), *see*
 satellite communications

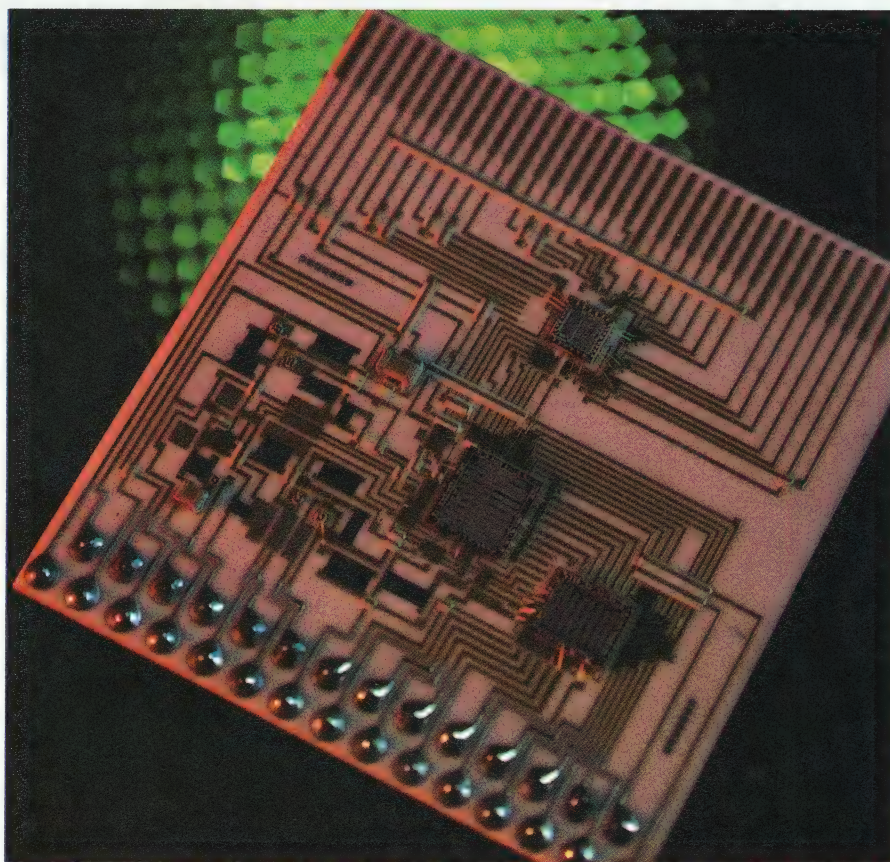


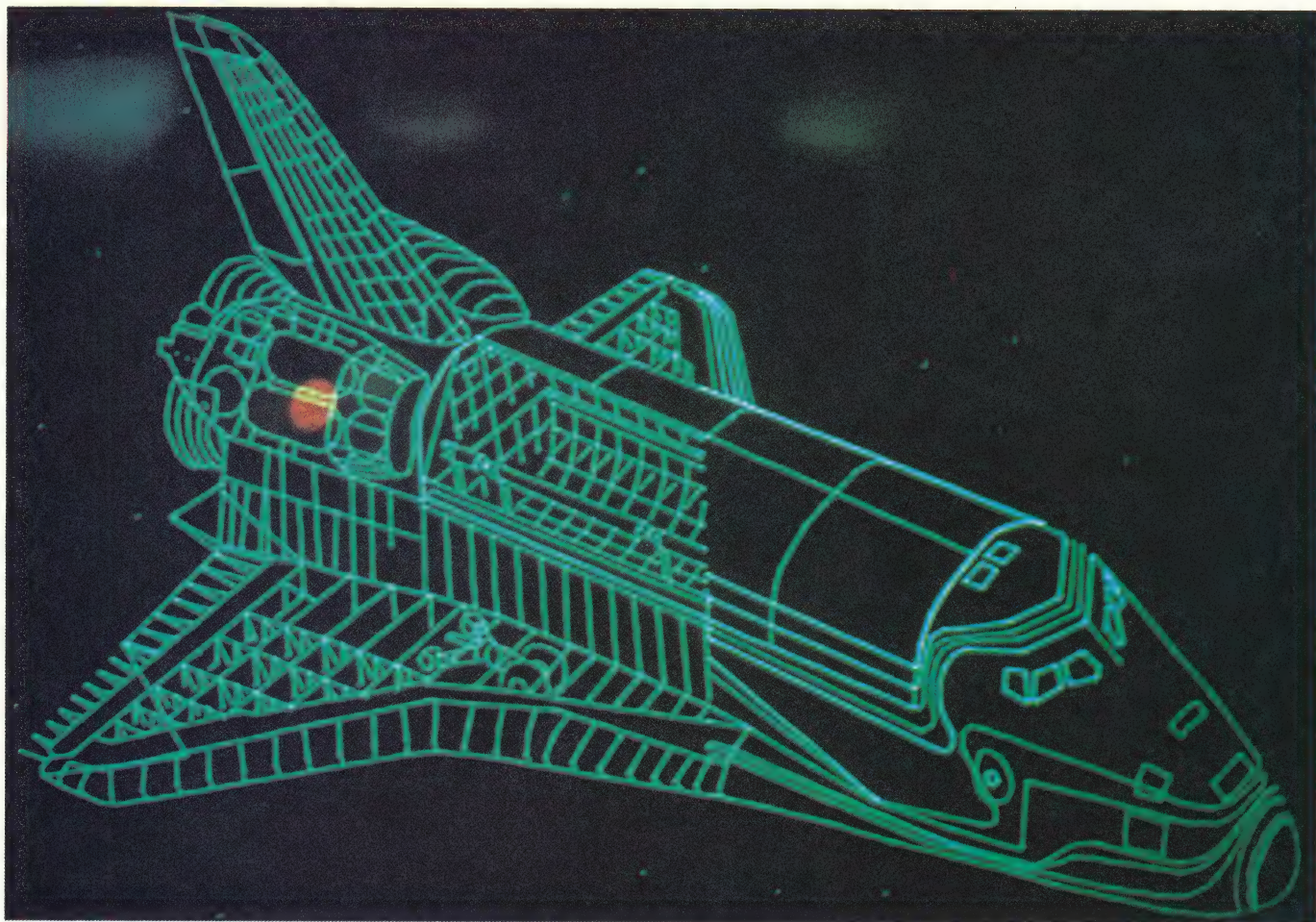
- Maritime Communications Service,
 see MCS
- MARitime European Communications
 Satellite (MARECS), *see* satellite
 communications
- Mark I computer, 6
- Mark II computer, 6
- mark reader, 265
- mass memory, *see* memory
- master-slave flip-flop, *see* flip-flops
- maximum power transfer, 811
- MCS (Maritime Communications
 Service), 1184
- Mean Time Between Failure (MTBF),
 see reliability
- Mean Time To Repair (MTTR), *see*
 reliability
- media converter, *see* memory: disks
- medical imaging, *see* medicine
- medicine, 650, 1046-53, 1493
 - EEG, 1049-50
 - graphics, 1411
 - INTERNIST, 663
 - management, 1048-9
 - medical imaging, 1046, 1051-3
 - nuclear medicine, 1052-3
 - ultrasound scanning, 1052-3
 - X-ray tomography, 1052
- MYCIN, 997-8
- NMR (Nuclear Magnetic
 Resonance), 1053
- PRAKTICE, 1051
- radio-frequency diathermy, 1049
- thermography, 1411
- Medium Scale Integration, *see* MSI
- MegaStream, 1520-1
- memory, 4, 15, 43, 60, 189-204,
 363-74, 459, 568-81, 641-9,
 838-40
 - accessing, 72, 74
 - accumulator register, 37
 - adder-subtractor, 37
 - address space, 71
 - analogue, 378-94
 - auxiliary, 648-9
 - bubble, 73-4, 202, 203, 644,
 646-7, 648, 649, 1460
 - bucket-brigade, 644-6, 1091
 - buffer, 73, 190, 590
 - cache, 73, 190
 - capacity, 4, 12, 190, 197, 200,
 1496
- CCD (Charge Coupled Device),
 644-6, 649, 1091-2
- central, 4, 190, 648-9
- components, 71-3
- core, *see* magnetic core
- data files, 363-74
- deletion, 370-2
- direct access, 199, 202, 569,
 606-16
- disks
 - clustering, 838
 - floppy, 194, 195, 200-2, 266-7,
 365, 366, 368-74
 - multidisk reader/media
 converter, 1324-5
 - optical, 840
 - rigid, 199, 318
 - Winchester, 196, 199, 200, 317
- display register, 34-5, 36, 37, 38
- DMA (Direct Memory Access), 75
- drop-out, 200
- drum, 202
- dynamic storage, 573-5
- EAROM, 195, 610, 649
- EEPROM (E²PROM), 195, 610,
 649

enable, 1273
 enlarging, 641-4
 EPROM, 195, 319, 579, 609-10, 1481
 film, 195-6
 fixed page system, 529, 584-8
 flag register, 35, 37
 flip-flop, 72, 193
 indexing, 368, 369-70, 373, 654-7
 inhibiting, 198, 202
 integral, 193-6
 labels, 368
 linked list, 369-72
 magnetic core, 72-3, 191-2
 manager, 584-8
 map, 522, 1216, 1417
 mass, 4, 74, 196-203, 363-74, 648-9
 types, 569
 memorisation, 189-90
 non-volatile, 72, 189, 193, 194, 607, 647, 649
 operand register, 36, 37
 optical, 839-40
 organisation, 363-6
 PROM, 34, 195, 548, 609-10, 869, 1159
 RAM, 75-6, 193-4, 569, 576, 579, 606-16, 641, 648-9, 1159, 1391-3, 1496, 1481
 dynamic, 193-4, 1092, 1357
 operation, 610-13
 static, 190, 193-4, 1530
 operation, 613-16
 registers, 34-5, 36-8
 ROM, 12, 15, 194-5, 211, 569, 579, 606-16, 648-9, 861, 925, 933, 1391-3, 1481
 oscillators, 1073-4
 teletext, 1041
 scratch pad, 522, 523
 sequential access, 75, 198, 367-8, 369-74
 serial access, 367-8, 569-72
 space list, 370-2
 static storage, 578-81
 tape, 4, 12, 197-8, 367-8, 569
 gaps, 367
 IBG (Inter-Block Gap), 367
 IRG (Inter-Record Gap), 367
 thrashing, 529
 types, 4, 12, 189-204, 569-81
 virtual, 529
 volatile, 72, 189, 194
 words, 4

see also data processing
 menu, *see* programs and programming
 merger program, *see* programs and programming
 Metal Oxide Semiconductor (MOS), *see* transistors
 Metal Oxide Semiconductor Field Effect Transistor (MOSFET), *see* gates; semiconductors; transistors
 meters, 1008-16, 1057-59
 sensitivity, 1010
 symbols, 1577
 see also analogue meters and digital meters
 MHD (MagneToHydroDynamic generation), *see* electromagnetism
 MICR (Magnetic Ink Character Reader), 265, 838
 microcomputer, 196, 389, 545, 1250-9
 busses, 1251
 clock, 1251
 control, 1251
 defined, 1250, 1451, 1505-6

I/O, 1251
 memory, 1250-1
 power, 1251, 1255-9
 microdrives, 1594
 micrographics, 899-900, 901
 microphone
 symbol, 1577
 microprocessor, 11, 172, 179, 213, 1151-61, 1192-1206, 1246-59, 1273-80, 1345-58, 1522-7, 1545-9, 1562-75, 1592-5
 addressing modes, 1305-9, 1510-11
 applications, 1385-95, 1464, 1473-8
 architecture, 1345-6, 1545-9, 1563-8
 bit classification, 1545-9
 bit length, 1248
 busses, 1251, 1345-6, 1548
 choosing, 1247-8
 clock, 1194-5, 1203-6, 1249, 1251, 1275-6, 1549
 combination, 1592-5
 components, 10-11, 568, 1248, 1251, 1273-80
 control signals, 1203-6, 1273-80,





1548-9
 data paths, 1194
 development, 1151-3, 1451-2
 encoding, 1132-6, 1192-4
 8-bit, 1464-82, 1592-5
 4-bit, 1153-61, 1350
 improving performance, 1157
 instruction set, 1153, 1248,
 1278-9, 1290-8, 1346-50,
 1385-90, 1419, 1420-1, 1438-9
 interrupt sequence, 1249, 1276,
 1464, 1467-8, 1480, 1513-14,
 1548
 I/O, 1251, 1275-6, 1417
 memory, 1158-9, 1250-1, 1273-5,
 1391-3, 1417
 operation, 1592-5
 package, 172, 218, 414-16, 1159
 DIL, 173, 431, 1421
 power, 1251, 1255-9, 1277, 1549
 program, 1156-7, 1158-9,
 1278-80, 1353-8, 1385-95,
 1415-22, 1434-40
 16-bit, 1505-16, 1522-7

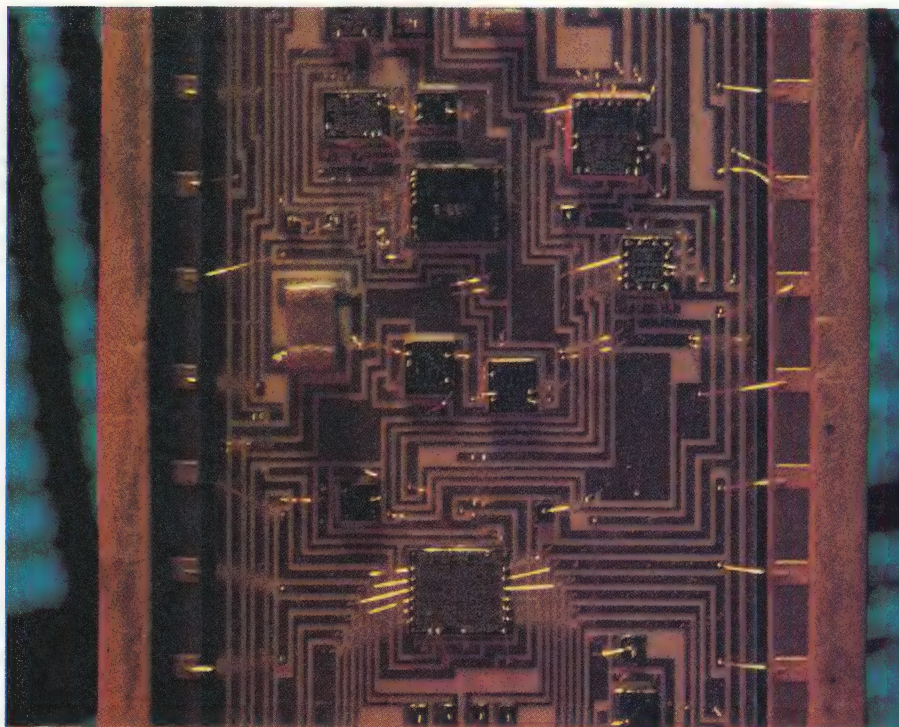
speed, 1248
 system evaluation, 1246
 32-bit, 1545-9, 1562
see also transputer
 MIDI (Musical Instrument Digital
 Interface), *see* music: synthesisers
 MINIMAX, *see* AI
 minority carrier, 118
 mips (millions of instructions per
 second), 1412
 MITI (Ministry of International Trade
 and Industry, Japan), 1003, 1004
 MMF (MagnetoMotive Force), *see*
 electromagnetism
 mnemonics, 13, 447, 1279, 1434
 macro, 1415
 modem (MODulator/DEModulator),
see telecommunications
 modulation, 56-7
 amplitude, 908-9
 frequency, 22
 phase, 1341-3
 modulator, 56-7
see also telecommunications:

telephone
 Moog Source, *see* music: synthesisers
 MOSFET (Metal Oxide
 Semiconductor Field Effect
 Transistor), *see* gates;
 semiconductors *and* transistors
 Most Significant Digit (MSD), *see*
 binary number system
 mouse, 266, 1217
 moving-coil meters, *see* meters
 MSB (Most Significant Bit), *see* bit
 MSD (Most Significant Digit) *see*
 binary number system
 MSI (Medium Scale Integration), 11,
 172, 174
 MTFB (Mean Time Between Failure),
see reliability
 MTTR (Mean Time To Repair), *see*
 reliability
 multidisk reader, *see* memory: disks
 multilayer semiconductors, *see*
 semiconductors
 multimeters, *see* meters
 multiplexers, 335-41, 1396-1402

analogue, 722-4
 dynamic, 1396-7
 envelope amplitude modulation, 908, 909
 FDM (Frequency Division Multiplexing), 907-8, 911, 1396-8
 frames, 1400
 guard bands, 1397
 s+dx, 1396
 single-ended, 724
 statistical/intelligent, 842, 1402
 telecommunications, 841-2, 883, 906-13, 1396-1402
 TDM (Time Division Multiplexing), 722, 911-13, 1397-1402
 tree structure, 338, 339
 see also demultiplexer
 multiprocessing, *see* data processing
 music, 762-3, 840, 935-45
 choosing a computer, 942-5
 event, 936, 937, 938
 Fairlight Computer Musical Instrument, 940, 940
 mixing, 945, 1099
 recording, 935, 944-5
 sequencing, 936, 937, 938
 sound and frequency, 795, 797
 step time, 936, 937, 938
 synthesizers, 762, 938-9
 MIDI (Musical Instrument Digital Interface), 941, 942, 943-4
 Moog, 939
 MUX, *see* multiplexers
 MYCIN, *see* medicine

N

National Television System Committee (NTSC), *see* telecommunications: television
 natural language, *see* language
 N-channel Metal Oxide Semiconductor (NMOS), *see* gates and semiconductors
 negative feedback, *see* feedback
 negative logic, 90, 100



networks, *see* data networks; LAN; WAN
 neutrons, 58, 112
 Newsfury, *see* telecommunications: television
 news gathering, *see* telecommunications: television
 Newton, 270
 NF (Noise Factor/Figure), *see* noise
 NMOS (N-channel Metal Oxide Semiconductor), *see* gates and semiconductors
 NMR (Nuclear Magnetic Resonance), *see* medicine
 noise, 483-5, 756, 769-70
 current, 484
 defined, 483
 excess, 484
 flicker, 484
 fundamental, 483
 interference, 483
 Johnson, 483
 NF (Noise Figure), 359-60, 484
 1/f, 484
 shot, 483-4
 signal-to-noise ratio, 392-4, 484
 thermal, 483
 white, 483
 non-volatile memory, *see* memory
 Norton's theorem, 810
 NOT gate, *see* gates
 n-p-n transistor, *see* transistors

NTSC (National Television System Committee), *see* telecommunications: television
 n-type semiconductor, *see* semiconductors
 Nuclear Magnetic Resonance (NMR), *see* medicine
 nuclear medicine, *see* medicine
 Nyquist plot, 1097-9

O

OCCAM, 1569-73
 OCR (Optical Character Reader), 265, 838, 953, 1325-6
 octal number system, 41, 123-4, 126
 octet, *see* byte
 office technology, 437, 497, 588, 650, 833-45, 891-905
 closed user group, 897
 electronic filing, 898-9
 electronic mail, 895-8, 904, 1004
 ergonomics, 903
 facsimile systems, 891, 1075-92, 1117-36
 micrographics, 899-900, 901



social implications, 902-5
 telecommunications, 841-5
 teleconferencing, 900-1
 teletext, 839, 897
 télex, 895-6
 videotex, 897
 viewdata, 897
 voice processing, 897-8
 Word Processing (WP), 840, 892-4
 see also banking and commerce
 offset nulling, 747
 see also op-amp
 ohm, 82-3
 Ohm's law, 119-20
 op-amp (operational amplifier), 389,
 732-47, 765-74
 bandwidth, 735, 765
 closed-loop, 735, 765

common-mode signals, 734
 comparators, 856-60
 differential amplifier, 732
 distortion, 769-74
 equalisation, 743
 error signal, 766
 feedback, 735-47, 765, 766-8
 gain, 735, 737-9, 765, 767, 771
 impedance (input and output),
 767-8
 integrators, 853-5
 lag, 739, 740
 low frequency roll-off, 745
 open-loop, 735, 738, 765
 oscillator, 742
 specifications, 773-4
 summing, 744-5, 766
 symbol, 1577

transfer function, 766
 unity gain buffer, 739-40
 wideband, 832
 Wien bridge, 742
 op code, 129, 1306, 1345
 operand, 67, 129-30, 1279-80
 operand register, *see* registers
 operating system, 363, 520-32
 BASIC, 521-3, 530-1
 batch processing, 523, 526, 528
 described, 520-1
 executive control, 523-4
 FORTRAN, 523, 524, 531-2
 interrupts, 524-5
 I/O control, 523-4
 job control, 523-4
 LRU (Least Recently Used
 strategy), 529, 587

mainframe, 530-2
 monitor state, 528
 multiprogramming, 525-7
 overlays, 528
 page, 529
 page fault, 529
 personal computer, 521-9
 privileged instructions, 527
 resident monitors, 523
 swap area, 529
 thrashing, 529
 time sharing, 528-9
 user state, 526
 see also data processing;
 memory; programs and
 programming; resource
 management
 operational amplifier, *see* op-amp
 operational system, 891
 operations code, *see* op code
 Optical Character Reader, *see* OCR
 optical fibres, 761, 805, 1281-9
 advantages, 1287-8
 cable TV, 1584
 connectors, 1288
 data capability, 1287
 data rate, 1286
 disadvantages, 1288-9
 distortion, 1284, 1285
 electrical isolation, 1288
 interference, 1288
 LAN, 1544
 length, 1284, 1285-6
 light sources, 1285, 1287
 material dispersion, 1286
 modal dispersion, 1283
 modes, 1283-4
 monomode, 1283-4
 multimode, 1283-4
 graded-index, 1284
 stepped-index, 1284
 optical computer, 1460
 plastic, 1289
 polymer, 1289
 Rayleigh scattering, 1285
 refractive index profile, 1284
 repeater distance, 1287-8
 security, 1288
 size, 1288
 structure, 1281
 types, 1283-4, 1289
 wavelength multiplexing, 1289
 optoelectronics, 617-20, 621-6,
 1260-72
 optical computer, 1460

optical fibre, 761
 optical isolator, 1266, 1267
 optically coupled electronic
 systems, 1265
 source-sensor matching, 1265
 Oracle, *see* telecommunications:
 television
 OR gate, *see* gates
 oscillators, 55-6, 849-52, 1071-4
 Barkhausen conditions, 849-50
 Colpitts, 852
 DCO, 938, 939
 function generator, 1073
 local, 1036
 low-frequency, 1073-4
 op-amp, 742
 phase-locked loop, 1072
 phase shift, 851
 quadrature, 854-5
 radio frequency, 1071-3
 reference, 1072, 1142
 relaxation, 602, 605
 VCO, 938
 Wien bridge, 850
 oscilloscopes, 668, 694-5, 1060-6,
 1142
 described, 1060
 display, 1060-4
 graticule, 1065
 horizontal amplifier, 1063
 storage, 1065-6
 timebase, 694, 1062-3
 usage, 1064-5
 vertical amplifier, 1063
 overflow flag, *see* flags

P

PABX (Private Automatic Branch
 Exchange), *see*
 telecommunications: telephone
 Packet Assembler/Disassembler (PAD),
 see telecommunications:
 telephone
 Packet Switched Exchange (PSE), *see*
 telecommunications: telephone
 Packet Switching Service (PSS), *see*
 telecommunications: telephone
 Packet SwitchStream, *see*
 telecommunications: telephone

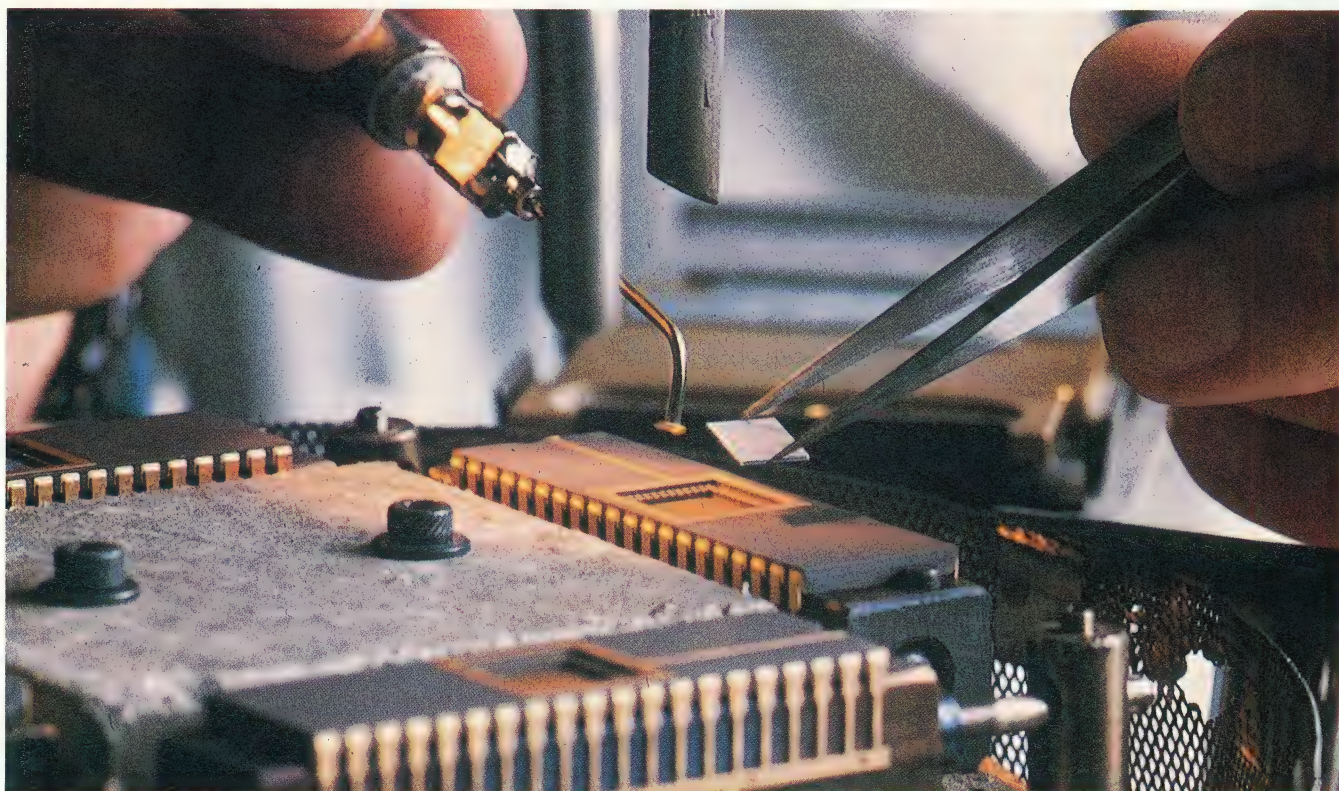
PAD (Packet Assembler/Disassembler),
 see telecommunications:
 telephone
 PAL (Phase Alternate Line), *see*
 telecommunications: television
 PAM (Pulse Amplitude Modulation),
 see facsimile systems
 paper tape, 837-8, 879
 paradigms, *see* AI
 parallel bit transfer, 7
 parallel circuit connections, 149-51
 parallel data transfer, 7, 190
 Parallel In/Serial Out (PISO), *see*
 registers
 parallel system, 1497
 parasitic capacitance, *see* capacitor
 parity flag, *see* flags
 PASCAL, 13-14, 1436, 1567
 control statements, 503
 loops, 503-4
 procedures, 504
 statements, 503-5
 structured programs, 505
 variables, 504
 global, 504
 local, 504
 pay-TV, *see* telecommunications:
 television
 PBX (Private Branch Exchange), *see*
 telecommunications: telephone
 PC (Personal Computer), 1449-60,
 1592-5
 applications, 1458-60
 described, 1449-53
 development, 1450-4
 markets, 1456-7
 software, 1458
 touch screen, 1456
 types, 1454-6
 p-channel Metal Oxide
 Semiconductor (PMOS), *see*
 gates and semiconductors
 PCM (Pulse Code Modulation), *see*
 telecommunications:
 telephone and voice synthesis
 pel (picture element), *see* pixel
 peripheral processor, 61-2, 75, 590
 peripherals, 4, 15, 75
 types, 254-69
 permeability, *see* electromagnetism
 permittivity, 206, 270-1, 329
 relative, 206
 symbol, 206
 Personal Computer, *see* PC
 Personal Identity Number (PIN), *see*

banking and commerce
 Phase Alternate Line (PAL), *see*
 telecommunications: television
 phase compensation, *see* frequency
 compensation
 phase control, 565
 phase modulation, 1341-3
 phase reversal, 400-1
 Phase Shift Keying (PSK), *see*
 telecommunications: telephone
 phase splitter, 555
 phasors, 596-8
 phosphorescence, 692
 photodiode, *see* diodes
 photo-emissive sensor, *see* light
 sensors
 photo FET, *see* transistor: FET
 photomask, 430
 photometry, 1260-1
 photomultiplier, 668, 669, 1080
 photons, 618
 emission, 625-6
 photoplotter, 430
 photoresist, 409
 photoresistor, *see* resistors
 photothyristor, *see* thyristors
 phototransistor, *see* transistors
 phototriac, *see* triac
 photovoltaic sensor, *see* light sensors
 picture analysis, *see* AI
 picture element (pel), *see* pixel
 piezoresistivity, 754
 PIN (Personal Identity Number), *see*
 banking and commerce
 pipelining, 1563-4, 1574
 PISO (Parallel In/Serial Out), *see*
 registers

pixel, 263, 1026-8, 1079, 1406-7
 PL/1 (Programming Language 1), 13,
 497
 PLA (Programmable Logic Array),
 861-74, 1592
 planar diffusion, 409, 410
 PLATO, *see* education
 PLC (Programmable Logic
 Controller), 1213-15
 PMBX (Private Manual Branch
 Exchange), *see*
 telecommunications: telephone
 PMOS (p-channel Metal Oxide
 Semiconductor), *see* gates and
 semiconductors
 p-n junction, 154-63
 asymmetric, 297-8
 avalanche breakdown, 669
 biased, 159
 capacitance, 160
 depletion layer, 158
 diffusion length, 297
 drift flow, 298
 injection efficiency, 297
 isolation, 411
 potential barrier, 158-9
 reverse biased, 160-3
 solar cell, 668
 space charge region, 158
 symmetrical, 297
 Point-Of-Sale (POS) terminals, *see*
 banking and commerce
 polling, *see* data processing
 ports, 919-20
 POS (Point-Of-Sale) terminals, *see*
 banking and commerce
 positive charge carrier, *see* hole
 positive logic, 90
 potential divider, *see* attenuators
 potentiometer, 48
 power, 152-3, 748-51, 846-8
 power dissipation rating, 79-80
 power factor, 847
 correction, 875-7
 power transistor, *see* transistors
 preamplifier, *see* amplifiers
 prescaler, *see* flip-flops: counters
 printers, 257-62, 1320, 1327, 1409
 barrel, 258
 chain, 257, 258
 daisy wheel, 259
 golf ball, 258, 259
 graphics, 1407
 impact, 258-60
 ink jet, 260

laser, 258, 260-1
 line, 258
 matrix, 259-60
 non-impact, 260-2
 plotter, 261-2, 1216
 thermal, 261
 types, 257-62
 see also publishing
 privacy, *see* security: data protection
 Private Automatic Branch Exchange
 (PABX), *see*
 telecommunications: telephone
 Private Branch Exchange (PBX), *see*
 telecommunications: telephone
 Private Manual Branch Exchange
 (PMBX), *see*
 telecommunications: telephone
 processor manager, 688-9
 program controlled transfer, 75
 program counter, *see* registers
 Programmable Logic Array, *see* PLA
 Programmable Logic Controller, *see*
 PLC
 Programmable Read Only Memory
 (PROM), *see* memory
 Programmable Unijunction Transistor
 (PUT), *see* thyristor
 programs and programming, 12-14,
 15, 60, 121-35, 437-53, 1415-22
 absolute, 630, 632
 BASIC, 500-1
 mainframe, 530-1
 personal computer, 521-3
 bootstrapping, 522
 bottom up, 441
 coding, 442, 497
 compiler, 14, 129
 concurrent, 1562-8
 debugging, 448
 design, 440-5
 development board, 1437
 documentation, 448
 external symbol table, 632
 flowcharts, 438-40
 FORTRAN, 506-7
 mainframe, 531-2
 personal computer, 523, 524
 hard-wired control, 929-33
 housekeeping, 521
 initialisation, 135
 interactive, 448, 498
 iteration, 443, 451
 library, 445
 loading, 134, 632
 loop, 443, 451





memory dependent instructions, 630, 631
 merger, 256
 microprocessor, 1434-40
 module, 444, 449-51, 1415
 object program, 446, 630
 PASCAL, 13-4, 503
 relational expression, 500
 relocatable, 630, 632
 running, 442-4
 sorting program, 451-3
 source program, 446, 447, 630
 specification, 438
 stages, 438-48
 stored, 4, 7, 12
 structured, 14, 445, 449-53
 sub-program, 441
 subroutine, 445, 446
 testing, 448
 tokens, 636-7
 top-down, 440, 441, 505
 translator, 446
 upward compatibility, 8-10
 variable, 929-30, 933-4
 see also data processing; data structures; language; medicine; von Neuman; WP Project Universe, *see* satellite communications

PROLOG (PROgramming LOGic), 663
 PROM (Programmable Read Only Memory), *see* memory
 protocol, *see* data processing and telecommunications
 protons, 58, 112
 PSE (Packet Switched Exchange), *see* telecommunications: telephone
 PSK (Phase Shift Keying), *see* telecommunications: telephone
 PSS (Packet Switching Service), *see* telecommunications: telephone
 PSTN (Public Switched Telephone Network), *see* telecommunications: telephone
 PTT (Postal, Telegraph and Telecommunications), 1518, 1519, 1553, 1559
 p-type semiconductor, *see* semiconductors
 Public Key Algorithms, *see* security: cryptography
 Public Switched Telephone Network (PSTN), *see* telecommunications: telephone
 publishing, 1320-31
 pull-up, *see* resistors
 Pulse Amplitude Modulation (PAM),

see facsimile systems
 Pulse Code Modulation (PCM), *see* telecommunications: telephone and voice synthesis
 punched cards, 5-6, 254-6, 313
 punched tape, 6, 256, 879
 PUT (Programmable Unijunction Transistor), *see* thyristor

Q

QAM (Quadrature Amplitude Modulation), 1343, 1344
 Quadrature Amplitude Modulation, *see* QAM
 Quadrature Phase Shift Keying (QPSK), *see* satellite communications
 quadrature voltage, *see* voltage
 queue, *see* data processing
 QPSK (Quadrature Phase Shift Keying), *see* satellite communications

R

radio, *see* telecommunications
 radiometry, 1261-2
 RAM (Random Access Memory) *see* memory
 ramps, *see* voltage
 Random Access Memory (RAM), *see* memory
 Rayleigh scattering, *see* optical fibres
 reactance, 685
 read buffer, 255
 Read Only Memory (ROM), *see* memory
 readability, 757-8
 real time, 592
 rectifiers, *see* diodes
 redundancy, 651, 816, 818, 991
 reflected voltage, *see* voltage
 reflection, *see* light
 refraction, *see* light
 regenerators, 1491
 registers
 accumulator, 37, 69
 address, 33, 43
 buffer, 365, 1400
 CRU (Communications Register Unit), 1510-16
 DAR (Direct Access Register), 1345
 display, 34
 flag, 35, 957-9
 IAR (Indirect Address Register), 1346, 1347-8, 1385, 1389
 instruction (IR), 33, 134, 1153-6, 1343
 operand, 37, 568
 parallel, 461-2
 PISO (Parallel In/Serial Out), 463
 program counter, 132, 1159
 RAM, 1157, 1160
 shift, 462-6, 1156
 analogue, 1091
 bidirectional, 466
 CMOS, 577-8
 four-phase, 577
 static, 578-81
 three-phase, 580
 two-phase, 573-6
 SIPO (Serial In/Parallel Out), 463
 status, 67, 254
 workspace pointer, 1435, 1510

relative permittivity, *see* permittivity
 relay, 381, 385
 reliability, 752-8, 961-7, 989-92, 1496-7
 bathtub curve, 962, 963
 calculating, 965-6
 cost, 964
 MTBF (Mean Time Before Failure), 962-3, 1496-7
 MTTR (Mean Time to Repair), 963
 parallel system, 1497
 probability, 989-92
 resistors, 990-1
 semiconductors, 991
 standby system, 1497
 weighting factor, 965-6
 reluctance, *see* electromagnetism
 remanence, *see* electromagnetism
 remote terminal, 12
 repeatability, 756
 repeaters, 1540
 Request Teletext, *see*
 telecommunications: television
 resistance, 83, 84-5, 119-20, 149-51
 characteristic, 1463
 networks, 1302-4
 winding, 1067-8
 see also resistors
 Resistor Transistor Logic (RTL), *see* gates
 resistors, 85, 149-51, 153, 627-9
 parallel, 718-19
 photoresistor, 665-7
 preset, 600
 series, 715-16
 shunt, 1012
 symbols, 1576
 variable, 378-9
 resonance, 775-8
 resource management, 582-92
 response time, 754, 755
 reverse gate current, *see* current
 Reverse Polish Notation (RPN), *see* language
 rheostat, 151
 Ring Interface Unit, *see* RIU
 ripple counter, *see* flip-flops: counter
 ripple voltage, *see* voltage
 rise time, *see* transistors
 RIU (Ring Interface Unit), 1540
 rms (root mean square), 629
 robots, *see* AI and industry
 roll-off, 949
 ROM (Read Only Memory), *see* memory

routine, 15
 add, 37
 idle, 34, 36
 RPN (Reverse Polish Notation), *see* language
 R-S flip-flops *see* flip-flops
 RTL (Resistor Transistor Logic), *see* gates

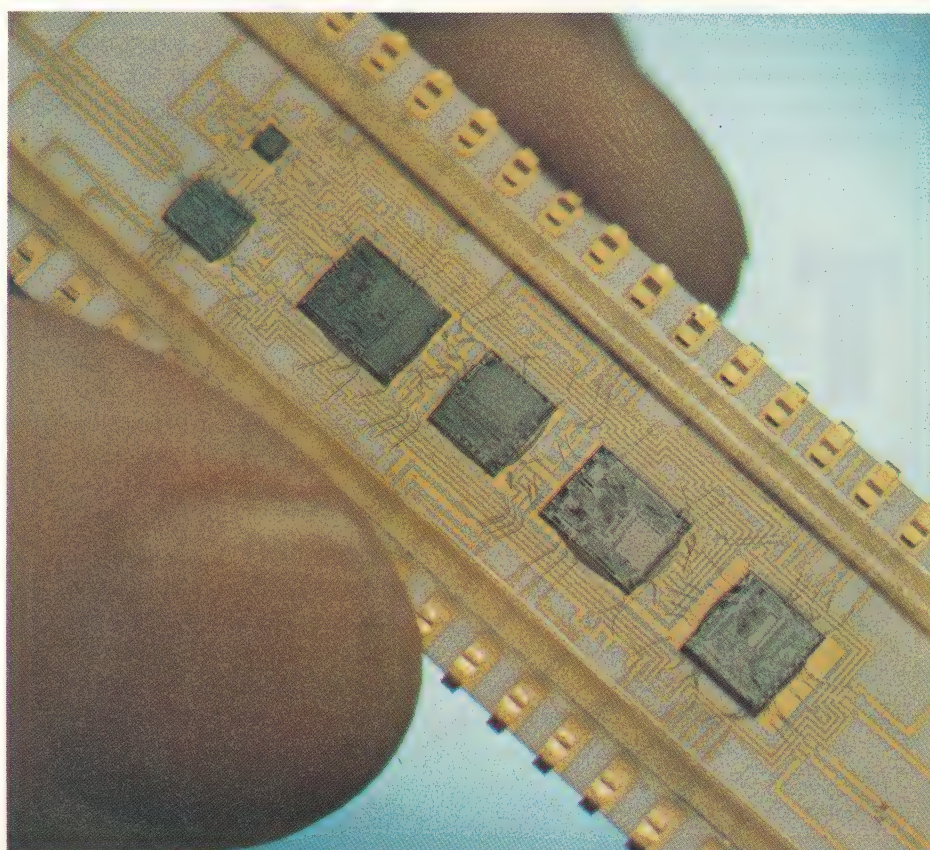
S

Sallen-Key filter, *see* analogue filters
 sample-and-hold, 681-2, 721-4, 727-31
 aperture error voltage, 728
 cross-talk, 730
 droop rate, 727
 EOC (End Of Conversion signal), 722
 errors, 727-8
 feedthrough, 728
 settling time, 730
 satellite communications, 1178-91, 1224-42, 1578-91, 1596-1600
 aerials, 1180, 1226, 1237-8
 Cassegrain reflectors, 1237
 EIRP, 1238, 1239
 gain, 1238
 amplifiers, 1189-90, 1232-7, 1239
 Apollo 12, 1238
 bandwidth, 1186-9
 beams, 1186, 1224
 data transmission, 1460
 DBS (Direct Broadcast to Satellite), 1040, 1184, 1241, 1582, 1585-91
 aerials, 1587
 C-MAC, 1585
 E-PAL, 1585
 diplexer, 1232
 down-link, 1180
 DSI/TASI, 1232
 earth stations, 1178, 1180-1
 ECS (European Communications Satellite), 1184
 EUTELSAT, 1184
 footprint, 1186, 1187
 frequencies, 1186-9

INMARSAT, 1184
 INTELSAT, 1183-4, 1191, 1227,
 1238, 1239, 1586
 interference, 1189-91
 line-of-sight, 1180
 L-SAT, 1586
 MARECS, 1184
 multiple access, 1188, 1191,
 1224-31
 FDMA, 1224-32
 SCPC, 1226-7
 SPADE, 1227
 SS-TDMA, 1231, 1241
 TDMA, 1227-32
 noise, 1189-91
 orbits, 1181-2, 1185-91
 Project Universe, 1600
 QPSK, 1232, 1235
 satellite, 1239-41
 SatStream, 1184, 1226, 1520,
 1596-1600
 coverage, 1597-8
 facilities, 1598-1600
 networks, 1600
 systems, 1183-4
 television, 761, 1040, 1578-91,
 1596-1600

transponder, 1180, 1239
 UNISAT, 1586
 up-link, 1180
 Satellite Switched TDMA
 (SS-TDMA), *see* satellite
 communications
 SatStream, *see* satellite
 communications
 scan line, 26-33, 932
 schools, *see* education
 Schottky diode, *see* diodes
 SCPC (Single Channel Per Carrier),
 see satellite communications
 SCR (Silicon Controlled Rectifier),
 see thyristor
 screening, 188
 SECAM (SÉquentiel Couleur À
 Mémoire), *see*
 telecommunications: television
 security, 652, 661-3, 1359-68
 banking and commerce, 1168,
 1171
 codes, 1359
 cryptography, 662, 1171, 1367-8
 DEA (Data Encryption
 Algorithm), 1368
 link encryption, 1367

Public Key Algorithms, 1367
 scrambling, 1367-8
 data protection, 1359-68
 Act, 1361-6
 privacy, 662, 1361-6
 electronic signature, 1368
 optical fibres, 1288
 ownership, 1368
 pay-TV, 1585-91
 signature verification, 1361
 value, 1368
 segment decoder, 34, 930-3
 selection unit, *see* multiplexers
 Selectric code, 42
 Semiconductor Research
 Co-operative, 1003
 semiconductors, 58-9, 77-81,
 112-18
 component manufacture, 321-8
 doping, 116-18, 154, 156
 extrinsic, 116-18
 intrinsic, 113-14
 MOSFET, 94-9, 143-7, *see also*
 gates and transistors
 multilayer, 561-7, 599-605
 noise, 483-5
 n-type, 59, 112, 116-18
 NMOS, 136, 144-5, 147
 p-type, 59, 112, 116-18
 PMOS, 143, 144-5
 reliability, 991
 see also diodes; p-n junction;
 transistors
 sequential circuit
 described, 240, 459
 sequential access memory, *see*
 memory
 SÉquentiel Couleur À Mémoire
 (SECAM), *see*
 telecommunications: television
 serial data transfer, 7, 190, 462
 Serial In/Parallel Out (SIPO), *see*
 registers
 service priority, *see* data processing
 seven segment display, 24, 29
 Shannon/Hartley law, 1337, 1432
 shunt resistor, *see* resistors
 Siemen, 83, 489
 sign flag, *see* flags
 signal generators, 1070-4, 1192-1206
 signal-to-noise ratio, *see* noise
 Silicon Controlled Rectifier (SCR),
 see thyristor
 simulation, *see* systems analysis
 Sinclair SuperBASIC, *see* BASIC



Single Channel Per Carrier (SCPC),
see satellite communications
 sinusoid, 593-5, 596-8, 1162-5,
 1175-7
 SIPO (Serial In/Parallel Out), *see*
 registers
 Small Scale Integration, *see* SSI
 Snell's law of refraction, 1282
 Society for Worldwide Interbank
 Financial Telecommunications
 (SWIFT), *see* banking and
 commerce
 software, 4, 1001
 solar cell, 668
 solenoid, *see* electromagnetism
 sound, 795, 813-15
 amplitude, 813-14
 envelope, 815
 frequency, 795, 796, 813
 mixing desk, 1009
 pitch, 813
 timbre, 814-15
 wavelength, 795
 SPADE, *see* satellite communications
 SPC (Stored Program Control),
 1536-7
 specification, *see* systems analysis
 spectrum analysers, 1144-50
 SSI (Small Scale Integration), 11, 172
 SS-TDMA (Satellite Switched
 TDMA), *see* satellite
 communications
 standby system, 1497
 star connections, 810, 811, 986-8,
 1017-19, 1043-5, 1101
 state analysis, *see* systems analysis
 static evaluator, 979
 status bits, *see* flags
 status register, *see* registers
 Stored Program Control, *see* SPC
 strain, 754
 strobe, 337
 structured programming, *see*
 programs and programming
 substrate, 9, 45, 324, 429
 subtraction, 69
 summer, 1432
 sum-of-products circuit, 283
 superconductivity, 1452
 superposition, 185, 808-11,
 1299-1301
 susceptance, 719-20
 SWIFT (Society for Worldwide
 Interbank Financial



Telecommunications), *see*
 banking and commerce
 switches
 symbols, 1577
 symbolic language, *see* language
 synthesisers, *see* music
 System X, *see* telecommunications:
 telephone
 systems analysis, 698-704
 systems evaluation, 1246
 systems software, 520-1

T

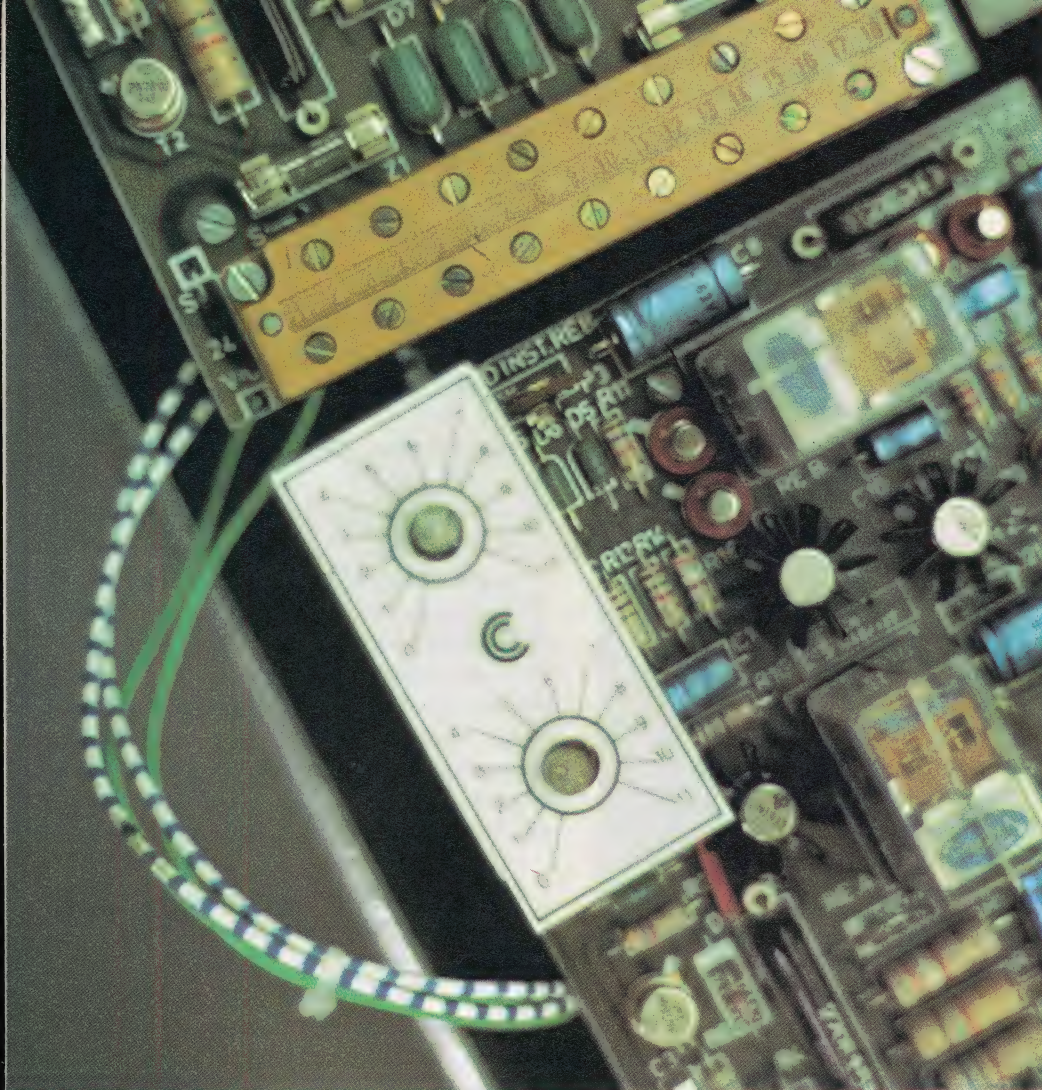
TACS (Total Access Communications
 System), *see*
 telecommunications: radio
 taps, 1584
 target computer, 630
 TASI (Time Assigned Speech
 Interpolation), *see* satellite
 communications: DSI
 TDM (Time Division Multiplexing),
see multiplexers
 TDMA (Time Division Multiple
 Access), *see* satellite
 communications

teaching, *see* education
 telecommunications, 794-807, 841-5
 facsimile systems, 891, 896,
 1075-92, 1117-36
 IT, 1498-9
 lasers, 761
 modem, 760, 841, 1079, 1325,
 1340-4, 1372-84, 1428-9,
 1440-8, 1498
 auto-answer/auto-dial, 1377
 baseband, 1376
 double dial-up, 1376
 fan-out/sharing unit, 1377
 multiport/multinode, 1377
 protocols, 1441-8
 pulse shaping, 1376
 split-stream, 1376
 types, 1372, 1375-6
 Morse code, 1336
 multiplexing, 841-2, 906-13
 newswire, 1329
 optical fibres, 761
 principles, 794, 878-85
 protocols, 1441-8, 1483-90
 radio, 1036-42
 beating, 1037
 cellular, 1004, 1313-19
 advantages, 1318
 base station, 1314
 clusters, 1315
 control channels, 1316
 described, 1313-14
 hand-off, 1315, 1316-17

industry, 1318
network switch, 1315-17
TACS, 1318
channels, 1036
data labels, 1040
detector, 1036-7
duplex channel, 1313
heterodyning, 1037
interference, 1036, 1313, 1315
mobile, 1313-14
principles, 1036-9
spectrum allocation, 1313
stereo, 1038-9
superhet, 1038
teleswitching, 1040
teleconferencing, 900-1, 1318, 1598
telegraph, 879-80, 1336
telephone, 380, 382, 393, 759-64, 878-90, 906-18
AM, 1341
automatic call forwarding, 1318
automatic re-dialling, 1318
bounded transmission media, 880-1
channels, 1337
cordless, 1314
delayed calls, 1318
demodulator, 1337-44
duplex circuit, 888
exchanges, 886-90, 913-17
FM, 1341
FSK, 1341, 1344
groups, 910, 1377
hunting groups, 1377
ISDN, 1535-6, 1560
LAN, 1537-44
local lines, 883
loop-disconnect signalling, 889
Merlin, 1338
mobile, 1313-19
modulator, 1337-44
multiplexing, 906-13
PABX (Private Automatic Branch Exchange), 844-5, 1171, 1532-6
advantages, 1536
analogue, 1535
DDI, 1535
digital, 1534, 1535, 1537, 1538
functions, 1532-6
ISPABX, 1534-5
reed relay, 1534
SPC, 1536-7

thyristor, 1534, 1535
types, 1533
PBX, 1532-6
PCM (Pulse Code Modulation), 912
PMBX, 1533
portable, 1314, 1318
Prestel, 1339, 1375, 1559-60
PSK, 1342
PSTN, 1314, 1315, 1316, 1336-44, 1372-84, 1397-8, 1423-4, 1428-9, 1498, 1519, 1559
QAM, 1343, 1344
regenerators, 883
repeaters, 884
signals, 906-13
switching, 1423-9, 1498-9
circuit, 884-5, 1423-4
message/store-and-forward, 1424-6
packet, 1427-9, 1442-3, 1517
advantages, 1429
Euronet, 1429
IPSS, 1429
PAD, 1428, 1443
PSE, 1428
PSS, 1172
SwitchStream, 1426, 1428-9, 1442-3, 1483-90, 1500, 1519
space division, 1534
time division, 1533-4
system load, 1424
System X, 917, 1560
Telecom Gold, 1339
terminals, 886-90
tones, 888-90
teleprinter, 879, 1329
teletypewriter, 1372-3
television, 392-4, 695-7, 1020-42, 1404
bandwidth, 1027
cable, 761, 1040, 1578-91
CATV, 1579
development, 1578-84
distribution, 1581, 1583-4
Europe, 1582-3
structure, 1580
cameras, 1028-31
colour, 695-7, 1028-35
components, 1020-1
DPA, 1330
ENG, 1329
ENS, 1328

fields, 1024-6
flicker, 1021
frames, 695, 1026
graphics, 1409-10
HDTV, 1585
Hunt Committee, 1579-82
lines, 693, 1021-6
'must carry' rule, 1578
Newsfury, 1329
news gathering, 1328-31
NTSC, 1025, 1035
PAL, 1025, 1034
Part Committee, 1585
pay-TV, 1578-91
pixels, 1026
principles, 1020-1
receivers, 1028-31
satellite, 761, 1040, 1578-91, 1596-1600
scanning, 1021-3
interlaces, 1025-6
pattern, 1024
SECAM, 1025, 1040
synchronisation, 695, 1021, 1024, 1031
systems, 1025-8, 1035
teletex, 896, 1376
teletext, 761-2, 897, 1040-1, 1331, 1552-3, 1554-8
Ceefax, 1041, 1556, 1559, 1560
Oracle, 1041, 1556, 1559, 1560
Request, 1560
transmitting and receiving, 1554-8, 1559
timebase, 695
video recorders, 761
video signals, 1023, 1024, 1031-4
videotex, 897, 1331, 1375, 1550-61
described, 1550-3
development, 1552-3
interactive, 1552-3
networked, 1552
vidicon tube, 1023-4
viewdata, 762, 897, 1041, 1375, 1552-3, 1559-60
telex, 880, 895-6, 1329, 1336
UHF, 1035
vestigial sideband modulation, 1027-8
VHF, 1035
see also CRT; data networks;



data transmission; office
technology; satellite
communications
teleconferencing, *see*
telecommunications
telegraph, *see* telecommunications
telematics, *see* IT
telephone, *see* telecommunications
teletypewriter, *see*
telecommunications
television, *see* telecommunications
teletex, *see* telecommunications
teletext, *see* office technology and
telecommunications
telex, *see* office technology and
telecommunications
terminals, 264-5
addressing, 1429
character, 1428
intelligent, 837
networked, 1170-1
on-line, 837
portable, 835
POS, 1169-71
timeshare, 1372-3
TRT (Text Retrieval Terminal),
1325
tesla, 402
Text Retrieval Terminal (TRT), *see*

terminals
thermionic valves, 6, 20, 48, 107
thermistor, 78, 851
thermography, *see* graphics
Thévenin's theorem, 184-5, 809-10
three-phase systems, 986-8,
1017-19, 1043-5
thyristor, 561-7, 599, 602, 603
applications, 563-5
characteristic curve, 561, 563
GTO (Gate Turn Off thyristor), 603
photothyristor, 665
PUT (Programmable Unijunction
Transistor), 604-5
SCR (Silicon Controlled
Rectifier), 561
structure, 562
symbol, 1576
time counters, 1137-43
Time Assigned Speech Interpolation
(TASI), *see* satellite
communications: DSI
Time Division Multiple Access
(TDMA), *see* satellite
communications
Time Division Multiplexing (TDM),
see multiplexers
time domain, 1144
timing diagram, 460

token passing, *see* LAN
top-down development, *see*
programs and programming
toroid, *see* electromagnetism
torque, *see* electromagnetism:
moment
Total Access Communications
System (TACS), *see*
telecommunications: radio
totem-pole output stage, 141
touch screen, *see* PC
transceiver, *see* data networks
transconductance, 489-90
transducer, 725-6, 752-8, 783-7
transformers, 375, 377, 458, 1054-6
audio, 1102-3
auto, 1102
construction, 1067-9
efficiency, 1100-3
hybrid, 906, 908
operation, 1054-6
pot-core, 1103
power loss, 1054-6, 1100-2
rectifier circuit, 225-7
regulation, 1067-9
step-down, 225, 1055, 1103
step-up, 225, 1055
symbol, 1577
three-phase, 1101
variatics, 1102
transistors, 8, 296-307
bipolar
amplifier, 302-4, 395-401, 820
applications, 399
bias, 396
characteristics, 350-62
common base, 400-1
common collector, 400-1
common emitter, 395-9
cut-off, 396
cut-off currents, 361
Darlington pair, 174-5
data sheet, 358-61
differential amplifier, 734
integration, 411-2
longtailed pair, 734
noise factor, 484
n-p-n, 303-4
p-n-p, 299-302
p-n-p-n, 561-7
saturation, 361
symbols, 1576
temperature effects, 354-5
collector junction, 299-302
common connections, 305

current gain, 306
 emitter junction, 299-302
 FET, 417-23
 amplifier, 467-74
 bias, 467-70
 common drain, 471-4
 common gate, 471-4
 common source, 471-4
 JFET, 417
 MOSFET, 417, 486-92, 549-55
 depletion/enhancement 487-8
 double gate, 490
 enhancement, 486-7
 transconductance, 489-90
 n-channel, 419
 p-channel, 419
 pinch-off, 420
 power dissipation, 357-8, 361
 power transistors, 80
 PUT, 604-5
 UJT, 600-2

see also diodes; gates; p-n
 junction; transputer
 Transistor-Transistor Logic (TTL),
 see gates
 translator, 630-40
 cross translation, 630, 631
 transmission lines, 1461-3, 1491-2,
 1528-31
 transparent latch *see* latches
 transponder, *see* satellite
 communications
 transputer, 1495-6, 1562-74
 channel, 1569
 described, 1562-8
 instruction set, 1570-1
 OCCAM, 1567, 1569-75
 processes, 1567-8, 1569-71
 programming, 1562-8
 range, 1567
 Travelling Wave Tube (TWT), *see*
 amplifiers
 triac (TRIode Alternating
 Current), 561-7
 applications, 566-7
 characteristic curve, 566
 symbol, 1576
 TRT (Text Retrieval Terminal), *see*
 terminals
 truth tables, 65, 89-90
 TTL (Transistor-Transistor Logic),
 see gates
 tunnelling, 1452-3
 TWT (Travelling Wave Tube), *see*
 amplifiers
 typesetting, *see* publishing

U

UJT (UniJunction Transistor), *see*
 transistors
 UniJunction Transistor (UJT), *see*
 transistors
 unit impulse, 1243
 Universal System Organisation,
 (USO) 16-17, 1417
 unreliability, *see* reliability
 upward compatibility, 8-10

V

valency band, 112, 117
 valency electrons, 58
 valves, 20, 48, 107, 172
 characteristic curve, 692
 variable programming, *see* programs
 and programming
 variables, 243, 499
 variac, *see* transformers
 varicap diode, *see* diodes
 VCO (Voltage Controlled Oscillator),
 see oscillators
 VDU (Visual Display Unit), 263, 1330,
 1331, 1428
 cursor, 263
 editing, 1321, 1331, 1496

 portable, 835
 timeshare, 1372-3
 videotex, 1550-61
 vector scan, *see* graphics
 verifier, 255
 Very High Frequency, *see* VHF
 Very High Speed Integrated Circuit,
 see VHSIC
 Very Large Scale Integration, *see*
 VLSI
 Very Very Large Scale Integration,
 see VVLSI
 VHF (Very High Frequency), 79
 VHSIC (Very High Speed Integrated
 Circuits), 1003
 videotex, *see* office technology and
 telecommunications: television
 vidicon tube, *see*
 telecommunications: television
 viewdata, *see* office technology and
 telecommunications: television
 virtual earth, *see* earth
 Visual Display Unit, *see* VDU
 VLSI (Very Large Scale Integration),
 11, 12, 1451, 1562
 voice adaptor, 1396
 voice processing, 897-8
 voice recognition, 812
 voice synthesis, 812-19
 linear predictive coding, 818
 pulse code modulation (PCM), 817
 volatile memory, *see* memory
 voltage, 82-3
 AC, 22
 bias, 396
 breakdown, 167-8,
 breakover, 561, 599
 constant
 DC, 22



delta connection, 986-8,
 1017-19, 1043-5, 1101
 large-signal, 396
 line, 986
 mutually induced, 457
 noise, 483
 open circuit, 768
 phase, 986
 pinch-off, 420
 quadrature, 717
 ramps, 709-10
 reflected, 1528-31
 ripple, 227
 sampling, 1430
 single-phase, 1043
 small-signals, 396
 star connection, 986-8, 1017-19,
 1043-5, 1101
 steady-state, 396
 symbols, 1577
 three-phase, 950-2, 986-8,
 1017-19, 1043-5
 trigger, 561
 Voltage Controlled Oscillator (VCO),
 see oscillators
 voltage gain, 389, 919-20
 voltage generator, 471
 voltage regulator, 170-1
 voltmeter, 82
 symbol, 1577
 von Neuman, John, 7, 1002, 1562
 stored program concept, 12
 VLSI (Very Very Large Scale
 Integration), 11

W

wafer, 117, 155, 157, 342, 407, 409,
 1378
 masking, 408, 409
 Waltz's
 procedure, 973
 set, 973
 WAN (Wide Area Network), 1004,
 1500, 1517-19
 Euronet, 1500
 see also KiloStream;
 MegaStream; X-Stream
 wand, *see* bar code: reader

waveforms, 1070-4
 waveguide, 1281
 weber, 331, 427
 weighting factor, *see* reliability
 Wide Area Network, *see* WAN
 Wien bridge, 742, 850
 Winchester, *see* memory: disks
 WIRED-AND, *see* gates
 WMO (World Meteorological Office),
 1135-6
 wobbles, 646-7, 648
 word generator, *see* logic analyser
 word management, 1321
 Word Processing, *see* WP
 words, 4, 71
 size, 1153
 workspace pointer, *see* registers
 World Meteorological Office, *see*
 WMO
 WP (Word Processing), 446, 892-4,
 1339
 checklist, 894
 context editor, 892
 dedicated, 892, 893
 described, 892
 package, 893
 proof-reader, 1321
 spelling checker, 1321
 usage, 893-4
 see also publishing

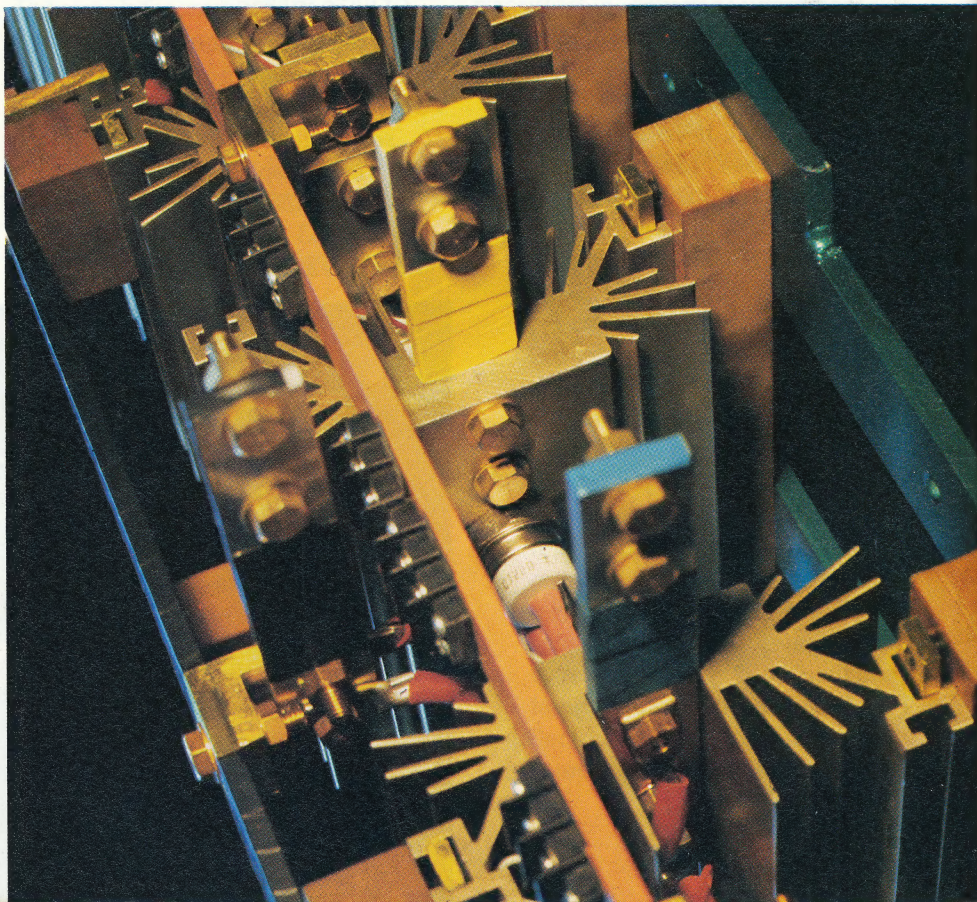
X

XOR gate, *see* gates
 X-rays, *see* medicine: medical imaging
 X-Stream, 1520

Z

Zener diode, *see* diodes
 zero flag, *see* flags

Index compiled by Edward Leeson.



How to order your binders...

These binders transform your copies into a handsome encyclopedia set – and give you maximum value from your home study course.

All you have to do to obtain your binders for I.T.E.C. is to tick the box(es) on the right and fill in your name and address on the section below. Enclose your cheque/postal order (made payable to G.E.J. Publishing Ltd). Fold carefully – following the instructions – to complete the reply paid envelope.

NO STAMP NECESSARY

If you tick both boxes on the right you will ensure that your future binders for I.T.E.C. arrive regularly, every ten issues. In this way you are saved the trouble of having to remember to order your binders individually and payment is simplified. There is no obligation on your part; you can cancel the standing order at any time.

How the binder set works: there are five binders in the complete set. You simply remove the covers from the weekly parts and store them, ten parts per binder plus the index part in the last binder.

☐ **Please send me my next binder now.**

I enclose cheque/postal order for £3.75 (including postage and packing).

If you require more than one binder to bring your collection up to date, please state how many binders you require and send cheque/postal order to cover the cost at £3.75 per binder.

☐ **I would also like to receive future binders as they are issued.**

I understand I will receive a payment advice for £3.75 (including postage and packing) with each binder, which I will pay only if I am absolutely satisfied with the binder. Otherwise I will return the binder and owe you nothing.

N.B. Please allow 35 days for delivery of your binders.

IMPORTANT: Please read this carefully:

1. Do not complete this form if you have already asked for binders to be sent to you automatically as they are issued.
2. Readers in the Republic of Ireland: please remit your payment in sterling.
3. Readers not in UK or The Republic of Ireland, see inside cover for details of how to obtain binders.



**FOLD 4
FOLDING INSTRUCTIONS**

Postage will be paid by licensee

Do not affix Postage Stamps if posted in Gt. Britain, Channel Islands or N. Ireland.

BUSINESS REPLY SERVICE
Licence No. WD1106

G.E.J. Publishing Ltd (E.T.)
187 Oxford Street
London W1E 5EZ

FOLD 4

Guarantee

If you are not entirely satisfied with your binder, send it back immediately and it will be either exchanged, or, if you prefer, your money will be refunded in full.